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Regulations and sociodemographic patterns in telemedicine use in Hungary in 2021 and 2024

PhD thesis

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List of Abbreviations:

AI	Artificial Intelligence
ANOVA	Analysis of Variance
CATI	Computer Assisted Telephone Interview
CDSS	Clinical Decision Support Systems
COPD	Chronic Obstructive Pulmonary Disease
COVID-19	Coronavirus disease 2019, a viral respiratory disease
CVD	Cardiovascular Disease
ECG	Electrocardiogram
EEG	Electroencephalogram
EESZT	Elektronikus Egészségügyi Szolgáltatási Tér National eHealth Infrastructure of Hungary. This is the abbreviation used when referring to the Hungarian EHR
EHR	Electronic Health Record This the term used when
EU	European Union
GALI	Global Activity Limitation Indicator
GDHI	Global Digital Health Index
GI	Gastrointestinal
GP	General Practitioner
HINTS	Health Information National Trends Survey
ICT	Information and Communication Technology
ID	Identification
IT	Information Technology
MEHM	Minimum European Health Module
NCI	National Cancer Institute
NDS	National Digitalisation Strategy
OECD	Organization for Economic Cooperation and Development
OENO	International Classification of Procedures in Medicine
O.R.	Odds Ratio
RSV	Relative Search Volume

TAJ	Social security Number
US	United States
WHO	World Health Organisation

1. Introduction

1.1 The focus of the research

Despite increased interest in telemedicine since the pandemic, research on its use is scarce. Less than half of OECD countries, including Hungary, have data on patient characteristics, type of telemedicine services and reasons for telemedicine use(1). The aim of this thesis is to fill this gap by analysing sociodemographic trends in telemedicine use. Because it is based on two nationwide representative surveys done 3 years apart, it can help understand changes in telemedicine use and development in Hungary in 2021 and 2024. Usage trend will be looked at within the framework of the legal and policy making context regulating telemedicine in Hungary because developmental patterns cannot be understood without considering the legal-regulatory environment. As Adeghe et al. state in 2024, understanding telemedicine trends can help policy makers facilitate its use to population segments who may benefit from it the most (2).

To avoid potential pitfalls, it is important to not only understands patterns of telemedicine use but also the policy and strategy environment in which telemedicine is practiced. As George and George (2023) phrase it, investing efforts in telemedicine development makes sense only if it contributes to effective, equitable and good quality healthcare(3). Hence after defining and discussing the relevant concepts, evidence will be provided from the international and Hungarian context to highlight that telemedicine solutions have the potential for improving healthcare provision. This is followed by the review of relevant literature on telemedicine use before detailing the research questions and methodology used for this thesis.

1.2 Basic concepts and definitions

Since the topic of the thesis is rather new and the terms used (digital health, eHealth, mHealth, telemedicine, teleconsultations, telehealth) are often confusing, it is very important to define what is meant by the main concepts. The complexity of the definition is made more difficult by the fact that different researchers and policymakers from different countries sometimes use the terms interchangeably. For example the American Telemedicine Association uses the terms *telehealth* and *telemedicine* as synonyms(4). OECD publications on the topic consider telemedicine a subclass of telehealth(1). Similarly, some authorities (see for example Oh et al, 2005) treat eHealth and digital health as synonyms while others look at digital health as the broader concept and eHealth as a subclass of it(5).

Let us start with the broadest term, 'digital health.' Defining the concept of 'digital health' can be challenging. In 2020, Fatehi et al reviewed nearly 1500 articles and found 95 scientific and lay definitions of the concept(6). They found that in describing digital health the relevant studies are more concerned with the way healthcare is provided and not with the kind of technological solutions used. Their literature review identified the following components of the concept: eHealth, mHealth, health 2.0, telehealth and telemedicine, public health surveillance, personalized medicine, self-tracking, wearable devices and sensors, genomics, medical imaging, and information systems.

Definitions of digital health focus on the way it can enhance health and promote care through digital means. The WHO definition of digital health is important as this is what much of the scientific literature uses. This definition looks at digital health as a large umbrella concept. It simply means the use of ICT in health in support of health-care. It has the following components (7):

eHealth – denotes the health-related use of ICT. Searching for health-related information online is the key use here. So is health-related discourse on social media. Another vital issue is how the internet may be used as a platform for health education by health authorities. The use of the concept is made more difficult by the fact that some publications use it as a synonym for digital health.

mHealth- means supplementing curative, preventive, lifestyle and public health services with mobile devices. This may mean telemonitoring of which more will be said in the telemedicine section, and the use of apps and wearables to collect health and lifestyle data about the person using it, mostly for their own interest. The devices used are often uncalibrated (step counters, sleep monitors, heartbeat monitoring etc…). mHealth is significant as it may help people manage their own health conditions and be more aware of health related issues in everyday life(8). Leigh et al. note a significant increase in interest in the general public after COVID-19 in mHealth technologies (9). Békási highlights the importance of lifestyle related apps and mobile devices related to physical activity, nutrition, sleep, stress management, community building and combating bad habits(10).

Telehealth means the use of ICT to provide health care from a distance. Clinical and non-clinical services are both included under this concept. Telehealth is often supported by eHealth solutions like ePrescriptions, Clinical Decision Support Systems (CDSS), Electronic Health Records (EHRs) and mHealth. Distance learning, telecare (for example as a supplement to assisted living for the elderly) and telemedicine are subclasses of telehealth (11). Hence the concept of telehealth is bigger in this definition than telemedicine. Telemedicine is mostly curative in nature while telehealth also includes rehabilitation, prevention, health education to name just a few uses.

For the purposes of this thesis, the most important concept is *telemedicine*, which is defined by the WHO as the provision of healthcare services enabled by information and communication technologies, particularly in situations where distance poses a barrier to healthcare.(12). Telemedicine refers to clinical services where telehealth also includes non-clinical services like health education. As the operationalisation of telemedicine into measurable indicators is needed for this research, it is helpful that this OECD classification differentiates 3 categories of telemedicine: a) telemonitoring, b) store and forward, and c) interactive telemedicine.

Telemonitoring is the use of mobile devices and platforms to monitor health related parameters remotely, share the results with doctors in real-time, so that doctors can respond based on the tele-results. (This is different from mHealth because here data is transmitted to the practitioner by the platform or app, while in mHealth data is only collected and the patient does the transmitting if it is transmitted at all). Examples may include blood pressure readings, diabetes monitoring or the use of any health sensor where the doctor gets the reading as well, not only the patient.

Store and forward is used for clinical data that are less time-sensitive and for which a delay between sending information and receiving an answer is acceptable. This is asynchronous communication. In the context of this thesis, it mostly means email communication between doctor and patient and sharing medical documents and images electronically, typically through EHR. Teleradiology is a well-known example.

Finally, *interactive or real-time telemedicine* involves immediate and synchronous communication between providers and patients. This is also called *teleconsultation,* and it is real time. Most studies, including the present one also consider telephone consultations, not only online video consultations like Zoom, Skype or Facetime to name just a few. The emphasis is not the technology used but on the function of carrying out a doctor patient consultation without the need to be present in the same location. These telemedicine solutions have subclasses, too. For example, there is telerehabilitation, which is a subclass of telemonitoring, there is teleradiology which is a subclass of store and forward and there is teletriage (meaning ICT use for giving health information and directives)(1).

As the focus of the present thesis is on telemedicine exclusively, it may be helpful to include further definitions used in the literature to get a better grasp of the concept. Serper et al.'s 2018 definition is useful as it provides examples of different telemedicine functions. In their conceptualisation the uses of telemedicine include scheduling remote visits with doctors, distant diagnosis grounded on patients' description of symptoms, remote monitoring of patients with chronic diseases, and remote analysis and description of laboratory and medical imaging results as well as teleconsultation (13). The next WHO definition describes some of the interventions for which telemedicine may be used for. Here telemedicine is taken to mean the delivery of healthcare services to distant locations by healthcare professionals using ICT to exchange information for the diagnosis, treatment, and prevention of illness and injuries, research and assessment, and training of healthcare providers, all in the interests of improving the healthcare services for the humanity(12).

In conclusion it must be noted that the differentiation between different aspects of telemedicine is rather arbitrary as in reality they often complement and enable each other. Synchronous teleconsultations would not be possible without asynchronous ePrescriptions, EHR use and other store and forward functions. Health related internet searches (eHealth) may also culminate in teleconsultations if it leads to social media sights where medical doctors answer questions.

Finally, although these definitions highlight the technological aspects of health related telesolutions, for the present purposes the main importance is on the human dimension, not the technical one. It is not the technological solution per se that the present study will be looking at but people's familiarity with it as well as the rules and laws facilitating or hindering its use(14). Telemedicine is more than just the application of digital technology in a new setting. As the World Health Organisation (WHO) states it, it is a cultural and social transformation of healthcare(15).

1.3 The role of telemedicine in health care

By 2015 close to 70% of European Union (EU) countries had strategies related to the use of digital solutions in health care, but less than 30% had one related to telemedicine. 69% of WHO Euro countries had legislation for electronic health records (EHRs), and even fewer on legal jurisdiction, liability, finance or big data use(16). As for telemedicine use itself, according to the OECD, there were pilot projects but nationwide, organised large-scale initiatives were scarce(17). As Meskó and Győrffy (2019) argue, the technology was there, but the cultural and organisational drive to use it was lacking (14).

The appeal of telemedicine was apparent during the lockdown when COVID-19 lead to conditions in which social contact had to be limited as much as possible. Suddenly it created the need for tools that were already there, just underused. Döbrössy et al. observe (2024) that "tele-solutions" like virtual classrooms, home officing, tele-shopping and teleconsultations were needed to deal with the new realities (18). It must however be noted that the significance of telemedicine goes beyond the lockdown. The solutions it offers have great potential even after that rather extreme period of physical isolation. There is evidence that it can alleviate long standing issues in health care provision. For example Kouroubali and Katehakis see digital health as a means to achieve healthcare for all(19). Girasek et al. state in 2022, that the promise of digital health in general and telemedicine in particular is that it can lead to more equitable and efficient healthcare addressing long standing problems like a) restricted access to health care services, b) problems caused by a scarcity of medical staff c) and issues of supervising and managing chronic conditions from home(20). Telemedicine can ease access to health care to marginalized populations. It may lead to better health outcomes through personalized treatment plans. It is due to these aspects that it can be a crucial component of techquity, a term coined by Clark et al. to denote the intentional design and deployment of technology both to advance health equity and to avoid deepening existing systemic inequities and health disparities(21).

The WHO emphasizes that telemedicine can be beneficial to achieving the Sustainable Development Goals by making health and wellbeing services accessible through digital means with high standards for all people globally(12). The almost universal problem of scarcity of health professionals is well researched (See for example Haakenstad et al. 2019)(22). It is important to note that the unequal regional allocation of medical professionals is also present in wealthy OECD countries not just poorer developing ones (23). Although formulated over 50 years ago, Tudor Hart's Inverse Care Law still applies today (24). The availability of medical care varies with the need for it in the population it is provided in. Fewer healthcare professionals seek employment in poorer areas where the need would be greater, and more in areas where the need is less. This is especially so where market forces are allowed to operate in healthcare resource allocation. It can be argued that currently more people may have better access to devices needed for online communication than to in-person medical care in Hungary. According to the Digital Hungary 2025 report, 94.1% of the population were internet users in January 2025. This means 9,09 million people in Hungary. The offline population is only 574 000 people (5.9% of the population) (25). At the same time the National Hospital Directorate-General (Országos Kórházi Főigazgatóság) reports that in December 2024 there were 839 permanently (for more than 6 months) unfilled GP practices in Hungary, across a total of 568 municipalities(26). This is about 1.3 million people according to the data of the Central Statistical Office (27). It doesn't mean these people do not have access to healthcare, it just means it is more difficult for them to access it because they must travel. As healthcare facilities offering outpatient specialist care are in towns and cities, access to this type of care is even more difficult for people living in villages. According to the 2022 census 2 388 288 people lived in villages and an additional 465 730 in bigger villages (nagyközség)(27). Therefore, if telecommunication-based consultations are the same quality as face-to-face visits, they save time and energy for patients and doctors alike. Studies supporting this notion are presented below.

A 2024 scoping review published in the Journal of Medical Internet Research by Dhunnoo et al. provides evidence that telemedicine benefits health outcomes(28). It focuses on real-time telemedicine consultations of chronically ill patients. Its three aims were to look at data on telemedicine consultations and health outcomes, understand telemedicine related attitudes of doctors and patients and to see how technology is used in tele-consultations. 19 studies were looked at. The studies included patients with COPD, diabetes, chronic kidney disease, ulcerative colitis, hypertension, and congestive heart failure. Most reported positive health outcomes from telemedicine use for chronic ill patients. Behesti et al.'s 2022 scoping review provides evidence that primary care telemedicine improves health care access for people in faraway places. It helps self-management and through this empowers patients. It decreases cost by limiting unnecessary referrals and reduces the need for commuting saving time and money (29). An other systematic review on telemedicine among adults with mental health conditions by Carillo de Alboronz and colleagues (2022) found that in primary care telephone and videoconference consultations were as effective as in-person visits to improve clinical outcomes(30). In their 2021 systematic review on telemedicine in different medical specialities Barbose et al. found that it improves access to care in a wide range of circumstances for people experiencing diverse health issues. It can alleviate problems caused by geographical inequalities but it is less effective in overcoming social inequalities(31).

Hungarian studies also lend support to the potential of telemedicine to improve healthcare provision. Virág et al (2025) report on a very promising initiative used in the least developed regions of Hungary combining telemedicine and mobile healthcare units to take medical services to the most underserved populations(32). Over the six-month study period, 1,889 people accessed care in 4,118 healthcare visits. As a result of the intervention, 105 new cases of hypertension and 26 new cases of diabetes were detected. This is a considerable health gain and a clinically significant result. Patient responses were quite favourable, with 96% indicating they would recommend the service to friends and relatives. Geography is not the only limiting factor in health care utilisation. Other marginalised populations may also benefit from telemedicine in overcoming barriers to receiving health care. One such study was done in 2022 by the Digital Health Research Group at Semmelweis University in collaboration with The Hungarian Charity Service of the Order of Malta among people experiencing homelessness(33). Participants in the pilot study were able to have diseases diagnosed and medication regiments altered because of the teleconsultations. Discussing the same study, Békási et al report high satisfaction levels from recipients and providers of teleconsultations alike(34).

The National Directorate General for Hospitals (Országos Kórházi Főigazgatóság) commissioned a telemedicine service and monitoring activities pilot project (EFOP-1.9.6-16). The following description is based on Misek (2025) (35). The project engaged 15,000 patients. Over 300 general practitioners, 50 specialists, and 10 healthcare institutions participated. It included 15,000 telemedicine procedures. Areas such as endocrinology, diabetes, dermatology, hypertension, and COVID-19-related screening and treatment planning, often utilizing pulse oximeters were covered. The main objective was to evaluate the effectiveness of telemonitoring and teleconsultation protocols and to identify patient and health care provider factors that might impact telemedicine use.

One of the protocols tested was entitled "Telemedicine-Supported Hypertension Screening and Therapy Management in General Practices." This initiative aimed to determine the practicality of monitoring blood pressure at home and to assess whether this method could reduce the frequency of in-person medical appointments. The results showed that many treatment plans were revised based on the data collected, indicating that telemonitoring contributed to improved health outcomes. Physicians also observed that patients showed better treatment adherence when telemedicine was involved.

Another protocol, "Care for Thyroid Patients Using a Teleconsultation Approach," was designed to study the use of teleconsultation for diagnosing and managing hypothyroidism and hyperthyroidism. The research aimed to measure how much faster care could be delivered with telemedicine and to estimate how many in-person consultations could be replaced by it. Doctors involved in the project reported that while this approach could help reaching a specialist faster, GPs would need to learn new skills and improve their clinical competences.

"Care for Patients with Type 2 Diabetes Mellitus Using a Teleconsultation Approach" was the third piloted protocol. This involved patient participation over a period of 14 to 30 days. Several patients had difficulties using the blood glucose monitoring devices, particularly when it came to connecting the equipment to their smartphones.

The fourth protocol, “Telemedicine-Supported COVID-19 Screening and Therapy Management in General Practices,” targeted individuals suspected of having had COVID-19. These patients were given pulse oximeters and a mobile app and were asked to record their oxygen saturation levels three times per week for two weeks. They were told to contact their healthcare provider if their results indicated the necessity of a medical intervention.

The final protocol, “Diagnosis and Treatment of Dermatological Diseases Using a Teleconsultation Approach,” had two main components: general skin lesion assessments and the evaluation of pigmented or potentially cancerous skin lesions using a dermatoscope.

In summary, participating doctors found telemedicine promising but encountered several difficulties. Many patients did not have an email, had technical issues with Bluetooth, passwords and such. They often played a bigger role than the doctors themselves in handling the day-to-day issues raised by the telemedicine project. The study also highlights the need for evidence based, tested protocols for specific telemonitoring and teleconsultation interventions. Health care providers need step by step protocol on how to use the technology, how to trouble shoot issues that may arise and how to safeguard confidentiality.

To conclude, the reviewed studies suggest that the potential of telemedicine to overcome issues burdening health care provisions is significant. It is also clear from the pilot project that protocols need to be developed to help health care workers use telemedicine efficiently.

1.4 Systematic literature review on general population survey studies and telemedicine use

The aim of this thesis is to explore and compare the population's telemedicine related habits and attitudes in 2021, during the pandemic, and in 2024, after the pandemic. Hence for our literature review original studies were sought that looked at general populations (not physicians) and telemedicine use and attitudes during and after the pandemic (March 2020). Several separate literature searches were conducted. PUBMED was searched with the following key terms (telemedicine) AND (survey) AND (population) AND (use) AND (knowledge) AND (attitudes). 47 articles were identified. Web of Science had 30 articles with the same search terms. All the Web of Science findings were also found on PUBMED: To expend the scope of articles, another search was conducted using (telemedicine) OR (teleconsultations) AND (survey) AND (demographic factors) on

PUBMED. This broader combination yielded 569 articles. The abstract of each article was read. The inclusion criteria were the following: a.) the study was done after March 2020, b.) the article was available in English, c.) it was done on the general population or a well-defined group of patients (diagnosed with depression, cardiovascular issues or diabetes for example) or a well-defined socio-demographic group (the elderly, people living in rural areas) d.) it dealt with telemedicine related attitudes and use and e.) it contained information on the sociodemographic characteristic of the respondents. One included study was about telemedicine related internet searches during the pandemic. Although it was not about use per se, but the volume on online enquiries on search engines about telemedicine use, it does show the time, and the countries where people showed high interest in it. Studies were excluded if a.) they were from the pre-COVID-19 era, b.) dealt with physicians or other health-care workers, and c.) were not about telemedicine use (but for example satisfaction with services.) After excluding duplicates and studies that did not meet the inclusion criteria, 29 studies remained. These studies, included in the evidence table, were read in full. The evidence table can be found in the appendix. Owing to the high degree of heterogeneity in the study populations, outcomes and measurement included in this study, a meta-analytic approach was not applicable. Data was analysed narratively. In assessing the strength of the studies, mostly issues of sampling method and sample size were considered. A good number of studies were done with social media-based convenience sampling, which raise issues of generalisability and representativeness. Other studies failed to define what they mean by telemedicine which also raise issues about the value of their results.

1.4.1 Geographical and methodological distribution of the studies

16 of the studies were conducted in the United States. 2 studies were from Italy, and one each from Switzerland, Jordan, Egypt, Pakistan, India, Saudia Arabia, Australia, Germany, the Netherlands, China. There was one international study, too. Five of the US studies used data from the Health Information National Trends Survey (HINTS). The Health Information National Trends Survey is a nationally representative survey conducted by the National Cancer Institute (NCI) in the United States. It is designed to collect data about how American

adults use health communication technologies and digital health tools among other topics. It has been done since 2003 and it uses mail surveys as well as telephone interviews (36).

1.4.2 Telemedicine use trends

A consistent trend across studies was the significant increase in telemedicine use during the early pandemic period (March-July 2020), with varying degrees of continued use thereafter. In their international study Wong et al. (2021) estimated telehealth demand during COVID-19 in the 50 most affected countries and compared it to their ICT development by extracting data on telemedicine related online searches(37). A spike in global telemedicine searches was noted from March 11, 2020, which levelled off in June-July 2020, but was still higher than before the pandemic. When evaluating associations between Relative Search Volume (RSV) and the ICT index, the United States and Canada had the most searches. Europe was considerably lower. Telemedicine searches and ITC development were not related. In general terms, the studies suggest that there was a steep rise in telemedicine use in the early stages of the pandemic followed by a decline in the period after the pandemic, but telemedicine usage rates levelled off at a rate higher than they were before the pandemic. Although there are variations, the studies identified disparities based on education, region, ethnicity, race income, age, and digital literacy suggesting that telemedicine may contribute to the increase of existing healthcare inequities.

1.4.3 Special patient population studies

These studies focused on well-defined patient groups (people with depression for example). One such study looked at parents of paediatric patients in Geneva in 2021. (Bajwa et al 2024) This non-representative study found that parents preferred telephone communication for simple medical advice, discussion of acute or chronic problems, and psychological support(38). Emails were favoured for disclosure of results and prescription renewal. The main reasons for preferring telemedicine were saving time and avoiding travel. Disadvantages reported were lack of physical examination and possible technical problems. The second paediatrics study by Mougey et al (2023) focused on patients with Gastrointestinal issues in the USA(39). This very strong survey compared in-person and telehealth paediatric care ambulatory visits for gastroenterology at a Children's Health

System and found a 145-fold increase in telemedicine use. There were great socio-demographic differences in telemedicine use. Ethnic and racial minorities were less likely to use telemedicine than the majority population. Patients with an increased likelihood of telemedicine use had broadband internet; were over the poverty level, owned their own homes and were university or college educated.

Gillenwater et al (2024) looked at patient preference in telemedicine in Maternal–Foetal medicine between March 2022 and May 2022 (40). 71% of patients felt that telemedicine is equal quality to face-to-face visits, and 79% were willing to use telemedicine in the future. Telemedicine was viewed positively or neutrally for physician attentiveness and comfort, too. Hispanic patients, patients with jobs, and patients with previous telemedicine experience were more favourable.

Von der Groeben and colleagues (2023) looked at telemedicine use, intentions to use it and demographic factors related to using telemedicine among people diagnosed with depression in representative German surveys carried out at 3 periods between June, 2020 and February, 2021(41). There was no difference in proportion of people who used telemedicine. Respondents reported that video and telephone consultations were too impersonal. Telemedicine was perceived more as a support rather than a substitute for face-to-face health care.

Dagher et al (2023) looked at cardiology patients in a New Orleans clinic and found that telemedicine was used more by younger, healthier, and better-educated people(42). The use of telemedicine went up in the pandemic in this study population, too.

Chen et al (2022) used medical charts and zip code level sociodemographic analysis to identify ethnic, racial and age disparities in telemedicine use for ophthalmology patients(43). They reached the conclusion that racial and ethnic minorities, older adults, and non–English-speaking individuals were significantly less likely to make use of video-based telemedicine for ophthalmic care during the study period.

Haynes et al in their 2021 American study used Electronic Health Record (EHR) data to compare characteristics of those who completed video consultations successfully with those who didn't to find socio-demographic factors related to telemedicine use for people undergoing diabetes care(44). Those aged 65 and over were less likely to use telemedicine.

This was also true for non-native English speakers and patients with public insurance. Technological barriers were cited as the most common reasons for choosing in-person care.

The next special patient population study is an Italian one on patients with Inflammatory Bowel Syndrome (Bosa et al 2022)(45). 77.9% of the respondents considered telemedicine valuable for managing their disease but only 26.3% believed that it is the same quality as in-person visits. Socio-demographic variables identified with trust in telemedicine were higher education and computer literacy.

Zaganjor et al used the US 2022 National Health Interview Survey to look at telemedicine prevalence of the previous year among American adults with no prediabetes or diabetes diagnosis, diagnosed prediabetes, and diagnosed diabetes(46). Telemedicine use was 34.1% and 28.2% among adults without diagnosed diabetes or prediabetes, 47.6% and 37.6% among adults with prediabetes, and 52.8% and 39.4% among adults with diabetes. It was lower among adults with prediabetes or diabetes living in nonmetropolitan areas, which is concerning as they are also the ones with the most difficult in-person access issues.

A study using the 2022 Health Information National Trends Survey is the one done in 2024 by Bhatla et al. on patients living with cardiovascular disease (CVD) or the risk of CVD(47). Individuals with CVD had the highest odds of using any telemedicine when compared with those without CVD or CVD risk factors.

Hung et al (2023) used data from the 2021 and 2022 National Health Interview Survey to investigate the factors associated with telemedicine use among adults with asthma(48). In 2021-2022, the prevalence of telemedicine use among adults with asthma was 47.7%. Women, obese people, current smokers and those with college and higher-level education were more likely to use telemedicine.

Maietti et al. (2020) studied the willingness of patients with diabetes to continue using telemedicine in Italy. Higher educated people and those not in employment were more willing to continue using telemedicine(49).

1.4.4 Sociodemographic disparities

All the studies looked at sociodemographic factors, but the studies in this section focus on marginalized populations. Odebunmi et al. analysed the 2021 National Survey of Older US

Adults (the age range was from 45 to 75) on their willingness to use telemedicine(50). Results indicate that inclination to use telemedicine decreased with age. Cost does matter. For those who were at first reluctant to use telemedicine services (aged 55 years or older), inexpensive or insurance-covered services were acceptable.

Smith et al (2021) looked at a predominantly rural population in Nebraska and found that only 25.5% had ever used telemedicine despite 97% of respondents having access to internet(51). People under 45, women, people having regular medical check-ups and people with higher education were the main telemedicine users.

In a 2022 Dutch study Sana et al. focused on sociodemographic and health factors to study telemedicine use in low-income Dutch neighbourhoods(52). 81% of the participants had contact with a GP service. 56% through telemedicine at least one time during the first wave of COVID-19. Female participants used telemedicine more often and participants aged 50 and over less often.

Ko et al. (2023) looked at whether telemedicine access and willingness to use it varied among rural and non-rural and low-income and non-low-income populations and found that rural and low-income populations had less access to telemedicine(53). Income was not a factor in access. When it came to willingness, neither settlement type nor income made a difference.

1.4.5 US general population studies

Zeng et al (2022) looked at 2020 HINT data to see how telemedicine use evolved at the beginning of the pandemic(54). Less than 50% of respondents used telemedicine before. The pandemic had an impact. It was the strongest among university educated people. Older age, lower income, and lower education were associated with decreased likelihood of telemedicine use.

Spaulding et al. (2024) looked at the prevalence of, inequities in, and primary reasons for teleconsultations in 2022 (55). 38.78% had teleconsultations in the previous year. Rates did not vary across age, race or ethnicity, income, and settlement type. This means that the disparities started to diminish two years into the pandemic.

Kim et al (2024) looked at the same set of results as Spaulding et al. to assess telemedicine use and factors associated with it in the United States(56). They found that the most important reason cited for not using telemedicine was providers not offering this option (63%), the most common reason for not using telemedicine when offered was preferring face to face care (84.4%). The most important reason for using it was doctors' recommendation (72.7%) and convenience (65.6%)

Ivanova (2024) et al. reproduced a nationwide survey in 2022 from 2017 to measure changes in telemedicine use and intention to use it(57). Telemedicine use was much higher in 2022 than 2017 (61.1% vs 5.3%). In 2022 34.5% used telemedicine with their primary care provider vs 3.5% in 2017. Intention to use telemedicine also increased.

Hung et al.'s US study (2023) found that high school graduates used the least telemedicine, while those with some college education or college graduates had higher use(58). Individuals with disabilities (35.40%) used telemedicine more than individuals without disabilities (20.21%). Interestingly, people over 80 years reported higher use than individuals 18 to 29 years old.

1.4.6 General population studies from the rest of the world

Of the general population studies, the Jordanian (Murshidi et al, 2022)(59), the Egyptian (Alboraie et al 2021)(60), the one from Pakistan (Tariq et al 2023)(61), the one from India (Naik et al 2023)(62), the Saudi (Alajwari et al 2023)(63) and the one from Western China (Wang 2021)(64) all suffer from the same methodological issues. They all used convenience sampling, either having questionnaires distributed opportunistically on social media or to the patients in hospital setting by the nurses. All studies reported increasing familiarity with telemedicine as the pandemic progressed. Respondents acknowledged its convenience during the pandemic. The proportion of people who have ever used it (ranging from 19% in Pakistan to 50% in Egypt) is much lower in every case than the percent who expressed willingness to use it. Of the studies that looked at sociodemographic factors, the Jordanian study found that higher educational degrees, living in urban areas, and having a higher digital literacy were associated with higher knowledge and better attitudes toward telemedicine. The Pakistani study noted that males had better perception of telemedicine. The Egyptian study reported that unemployed and less-educated participants were less informed and had favourable attitude towards telemedicine.

According to Thomas et al.'s 2023 Australian representative study, 69.3% of those who received health care in the previous year used telemedicine(65). Although Older people had more medical encounters, they were less likely to have had a teleconsultation. Higher educated people were more likely to utilize telemedicine. 71% held that the outcome of their consultation was the same as it would have been in person, and 57% said it was the only way to see a doctor.

To conclude, studies observed a rise in telemedicine use in the early period of the pandemic. Most studies found socio-demographic differences. More educated people were more likely to use telehealth solutions as were people 45 years old and younger. Where gender was looked at, in most cases women were the more likely users.

1.5 The (absence of) regulation of telemedicine in Hungary before the pandemic

After appraising factors influencing the digital health development of nearly 20 European countries, the Bertelsmann Stiftung-Empirica research institute observed that successful digitalisation in health care can't happen without governmental strategy, political stewardship, a clear national mandate and designated agencies(66). The WHO is also in agreement in that relevant programmes, policies and regulations are the prerequisites for the implementation of digital health on a national scale (67). Telemedicine was not addressed in health-sectorial and digital strategies in Hungary before the pandemic. The word 'telemedicine' or any of its synonyms was only mentioned once in the 97 page '*For a Healthy Hungary' 2014-2020* (68). On page 5 it says that ' *In addition, it is of key importance to leverage sector-specific IT developments and to make technological and digital innovations accessible to the population (ePrescription, telehealth, telemedicine, etc.)*'(69). As for general governmental digitalisation strategies, there were only brief mentions of telemedicine (or any of its possible synonyms). The 2017 *Digital Wellbeing Program (Digitális jóllét Program)* included a short section on the development of *Digital Healthcare Industry Strategy (Digitális Egészségipari Fejlesztés Stratégia)* but in essence it was a purely theoretical document containing no tangible initiatives and telemedicine solutions were not even mentioned(70). Hungary was one of the nine OECD countries where doctors were required to be physically present with the patient when making a diagnosis or implementing therapeutic changes (1). Hungary was not unique in failing to develop a country level digitalisation strategy. This is despite the urgings of the WHO(71) and the European Commission (72).

2. Objectives

The aim of this thesis is to understand changes in patterns of telemedicine use in Hungary in 2021 and 2024 within the framework of the telemedicine related legal-regulatory environment. As such it has two pillars, researched with different research methodologies.

2.1 The policy pillar objective

The policy pillar aims to examine the evolution of telemedicine related regulation in Hungary. This is a systematic analysis of decrees, laws, regulations and policies. As observed by Saliba et al. in 2012, telemedicine can only flourish in a supportive environment (73). Regulations and policies that support its implementation are essential prerequisites for widespread adoption of telemedicine. Clear strategy committed political support, a well-defined national directive, and specialized agencies are needed. Therefore, the objective of this pillar is to conduct a systematic review of relevant databases to identify policies pertaining to telemedicine in Hungary.

The objectives of the policy pillar are two-fold:

1. Identify and analyse telemedicine related regulatory documents in Hungary.
2. Identify and analyse telemedicine related governmental and health sectorial strategy to predict future trends and directions.

2.1.1 Policy pillar hypotheses

Our hypotheses are the following regarding the policy pillar:

H1: Before 2020 March, the legal framework regulating telemedicine in Hungary was fragmented and unprepared for telemedicine use.

H2: The COVID-19 pandemic accelerated not only telemedicine use but regulatory governmental activities as well.

H3: Current health care strategy pays much more attention to telemedicine than in the pre-COVID-19 era.

H4: Rapid policy making activities facilitated use of telemedicine in Hungarian healthcare stings.

2.2 Quantitative population survey pillar objective

The aims of the survey pillars are as follows:

1.To compare the frequency of use of telemedicine solutions (online appointment booking, teleconsultation, email communication, image sharing, document sharing, health status monitoring) in 2021 and 2024.

2. To create a composite Telemedicine Index and examine its change over the two measurement points.

3. To investigate the role of perceived advantages and disadvantages of digital health solutions in relation to the Telemedicine Index.

4. To identify the socio- demographic factors influencing the Telemedicine Index at both time points.

2.2.1 Survey pillar hypotheses

Our hypotheses are the following regarding the survey pillar:

H1: The frequency of using telemedicine solutions will be significantly higher in 2024 than in 2021.

H2: The average value of the Telemedicine Index will be significantly higher in 2024 than in 2021, indicating a wider spread of telemedicine solutions.

H3: With the increasing adoption of telemedicine across all socio-demographic groups, disparities in its usage are likely to diminish between 2021 and 2024.

H4: Social and family support positively correlates with the use of telemedicine solutions at both measurement points.

H5: Among individuals with chronic illnesses, the use of telemedicine solutions will be higher in 2021 than in 2024, and in 2024, they will use these solutions more frequently than those without chronic illnesses.

H6: Those who perceive more advantages in telemedicine solutions will use them more intensively.

3. Methods

3.1 Policy methods

The method used here is a qualitative narrative analysis of legislation with the approach of a systematic literature review. A similar method was used by Roziqin et al. (74). The National Legislation Database (Nemzeti Jogszabálytár https://njt.hu/) was searched. All Hungarian legal announcements, laws, decrees and regulations are made available on this site. It can be searched by keywords, type of document and date. The search terms (in Hungarian) used were: “digitális egészség” (digital health), “telemedicina” (telemedicine) “távorvoslás” (Teleconsultations) and “EESZT” (Electronic Health Records). The search period spanned from January 31, 2020. (when the Operative Board responsible for coordinating COVID-19 related activities was set up by the Hungarian government) to July 31, 2024. Our search identified 60 laws (including modifications of previously existing laws), governmental and ministerial decrees, normative decisions, and normative instructions. 47 documents remained after removing duplicates. Only legislation pertaining to digital health, telemedicine, or the functioning of EHRs was included in the analysis. Certain identified material just applied existing legislation to special populations like soldiers or refugees and hence were excluded as they were not new legislations just the temporary adaptation of existing regulations to deal with COVID-19 in special populations. Legislation which had no bearing outside of COVID-19 (like digital vaccination certificate for example) were excluded. 41 documents were removed after implementing these criteria. The six remaining documents form the fundamentals of the policy pillar analysis. As the focus is mostly on telemedicine in this thesis, the 3 telemedicine related pieces of legislation will merit the deepest exploration. Although not telemedicine in the true sense of our definition, legislation on ePrescription and EESZT (the Hungarian version of EHR) will also be looked at because these are prerequisites of a successful telemedicine system. The abbreviation EESZT is used when talking about the Hungarian EHR. EHR is the term used when talking about Electronic Health Records in general. An illustration of the need to broaden the concept in the present analysis is provided by ePrescriptions. Many consultations end in prescriptions, so legislation on ePrescriptions is vital to make the system work. A regulated system of telemedicine would not function with unregulated ePresciptions. EESZT is vital for 'store and forward' telemedicine functions. That is why the scope was broadened from strictly telemedicine to other functioning of the digital health system. The 6 relevant legislations identified are as follows:

a.) 8/2020 Decree of the Ministry of Human Resources (12 March) on easing the use of ePrescriptions(75); b.) Government Decree No. 157/2020. (29 April) on Certain Health Measures Ordered During the State of Emergency known as the Telemedicine Decree(76), c.) Act No. LVIII of 2020 (17 June) on Transitional Rules Related to the Termination of the State of Danger and on Epidemic Preparedness, Section 37: Transitional Rules on Healthcare Matters (77); d.) Decree No. 33/2020 (16 September) of the Ministry of Human Capacities on the Amendment of Decree 60/2003 (20 October) of the Minister of Social Affairs and Health on the Professional Minimum Requirements for the Provision of Healthcare Services, on the Definition of Outpatient Specialist Care Activities Financed by the Health Insurance Fund, on the Eligibility Conditions and Rules Applicable during Utilization, and on the Modification of Decree 9/2012 (28 February) of the National Institute of Pharmacy and Nutrition on the Settlement of Performance (78), e.)1658/ 2020 (15 October) Governmental Decree on the establishment of a telephone and online information centre (79) and f.) Governmental Decree 57/2021. (10 February) on Videotechnology Facilitated Teleconsultations with Possible Face Recognition (80).

Besides legislation, three relevant strategy papers were identified through desk research. These are as follows: a.) For a Healthy Hungary 2021-2027 – Healthcare Sectoral Strategy – Ministry of Human Resources, 19 January 2021 (69); b.) National Health Informatics Strategy(81) accepted in July 2021 and c.) National Digitalisation Strategy (NDS) 2022-2030(82).

3.2 Survey pillar methods

The surveys were done as part of the research program "E-patients and E-physicians in Hungary: The Role and Opportunities of Digital Health Solutions in the Healthcare System" (OTKA-FK 134372), supported by the National Research, Development, and Innovation Office (NKFIH). Two large scale nationwide representative cross- sectional surveys were carried out within the framework of this project. The study was approved by the Medical Research Council – National Body, Hungary). The licence number is IV-10927-1/EKU. Informed consent was obtained from all subjects. Participation was anonym and respondents were free to drop out at any time from the study. They received no compensation for being involved in the survey.

3.2.1 The 2021 and 2024 population questionnaire

For this thesis the only difference between the 2021 and 2024 questionnaires was in the mode of administration. The questionnaire is self-developed based on international research experience. It has 25 items and took an average 15 minutes to complete. The English translation of the questionnaire is available as appendix1. As the thesis focuses exclusively on sociodemographic factors, attitudes and telemedicine use, only those questions relevant to the current study are detailed here.

Sociodemographic variables were enquired about based on the following indicators: a) age, b) gender, c) type of permanent residence (capital, country seat, town, village) d) county, e) region f) educational attainment (primary school or lower, vocational training school / trade school (without high school diploma), high school / secondary technical school (with high school diploma) university / college degree) g) family status (single, in a cohabiting or long-term relationship, married, living separately, divorced, widowed) h) number of children under 18 years i) labour market status (employee in a managerial position, employee without subordinates. self-employed, independent entrepreneur - employs staff, old-age pensioner, disability pensioner, widow's pension, unemployed, studying in full-time education, receiving maternity/paternity benefits, homemaker, other typer of inactive earner, other dependent).

Chronic Illness status was asked on a yes- no question. For the purposes of the study, a condition is considered long-term if it has lasted for at least six months or is expected to last for at least six months. If the answer was affirmative the type of long-term illness or health problem was asked in an open-ended question.

Data on telemedicine use was collected by asking respondents whether they are using or have ever used the following: a) telemonitoring, b) store and forward, and c) interactive telemedicine (teleconsultations). The concept was operationalised into the following measurable variables on which information was collected on a) email communication with a doctor (Q14/1), b) sharing images with a doctor (Q14/2) c) sharing medical documentation with a doctor (Q14/4) d) online appointment booking and referral requests (Q14/9), e) remote consultations (Q13a/6) and f) doctor monitoring health status via smartphone (Q14/5).

The next question was about the perceived positive consequences of using digital health solutions. Respondents were asked to agree or disagree (yes or no) with the following statements about telemedicine: a) it improves the efficiency of healthcare, b) it improves the safety of healthcare, c) it helps patients cooperate better in the healing process, d) it is convenient, e) it reduces the number of personal doctor-patient visits, f) it saves time, g) patients can access healthcare services faster, h) doctors involve patients more in the healing process, i) patients can receive higher quality care, j) it reduces the chance of medical errors, and k) it improves doctor-patient communication. The perceived negative consequences of digital health solutions were also enquired about by asking respondents to agree or disagree with the following (by answering yes or no) : a) care quality will worsen, b) it frustrates patients/doctors (e.g., due to technical difficulties); c) patient satisfaction decreases; d) it may lead to overdiagnosis, e) it overloads healthcare systems, f) patients misinterpret the health data shared with them, g) faulty technology could endanger patient recovery personal data is less secure, h) it increases administrative burden for doctors, i) it increases the risk of doctor burnout, and j) care becomes more impersonal.

3.2.3 Data collection

In 2021 the survey was done on a nation-wide representative sample. It was a computer assisted telephone interview (CATI). Data collection took place between October 5 and 13, 2021 by Ipsos Zrt. The sampling frame included 12,000 individuals randomly drawn from a public telephone directory, supplemented by an additional 8,000 people as a reserve sample. Of those contacted, 11,733 declined to participate, and 1,293 dropped out—primarily due to quota-related reasons. During data collection, 80% of contacts were made via mobile phones and 20% via landlines. To enhance the representativeness of the data, corrective weighting was applied. The final analysis was based on a weighted sample size of 1,500 individuals.

The 2024 survey was conducted using fundamentally the same measurement tool as the 2021 study. For financial reasons the second survey was not CATI but online. It was programmed by Ipsos Zrt. who also carried out the data collection. The sample consisted of a 1,000-person quota sample, which was representative of Hungary's adult population in terms of gender, age, settlement type, region, and educational level. Data collection took place between February 12 and 22, 2024.

3.2.4 Statistical analyses

The data analysis was carried out using the IBM Statistics statistical analysis software.(83). During the statistical data processing, distribution analyses, chi-square, and analysis of variance (ANOVA) were performed. In interpreting our statistical tests, a 5% ($p<0.05$) significance level was used. The non-parametric Kruskal–Wallis test and in the case of comparing two groups, the Mann–Whitney U test was also used. To examine the constructed Telemedicine Index, multinomial logistic regression analysis was used by breaking down the Telemedicine Index into the following categorical variables: does not use telemedicine tools, uses up to 2 telemedicine tools, uses at least 3 telemedicine tools. Pearson correlation was used to compare perceived advantages and disadvantages of telemedicine use.

4. Results

4.1 Policy results

As Döbrössy et al conclude in their 2024 '*The Adaptation of Digital Health Solutions During the COVID-19 Pandemic in Hungary: A Scoping Review'* policymakers in Hungary used a quick succession of temporary state of emergency regulations and decrees to facilitate an increase in the number of teleconsultations(18). *Figure 1* illustrates the timeline of telemedicine related legislation in Hungary.

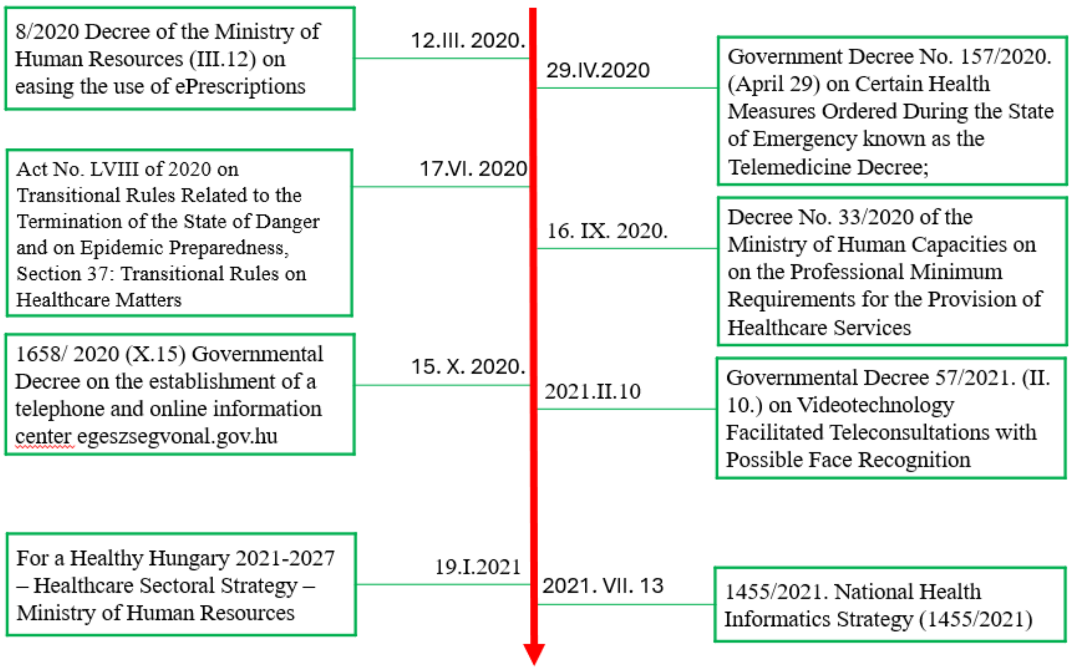

Figure 1. Digital Health Related Decrees and Legislations Passed During the Pandemic. Based on Döbrössy et al. (18)

8/2020 Decree of the Ministry of Human Resources (III.12) on easing the use of ePrescriptions is significant beyond itself because it was one of the first lockdown related actions of the government. ePrescritions existed in Hungary before the pandemic but their use was awkward as it was difficult to delegate a proxy to have the prescribed medication dispensed. Written permission signed by witnesses would have been required to delegate the responsibility for having ePrescriptions filled. This decree eased that. After identification at the pharmacy, anybody can take out other people's prescriptions as long as they know the person's Social Security Number (TAJ). The pharmacy is obliged to record the proxy's data and have the receipt signed. ePrescritions went up from 8000 a day before the pandemic to 800 thousand by 2021(18). Such an increase could not have happened without this legislation. The use of ePrescritions is now a part of everyday life for much of the population. As Girasek et al (2025) report on the findings of the Digital Health Research Group at Semmelweis University, 95.1% of respondents heard of it in 2024 and 85.7 % actually used it.(84) In 2021 these numbers were 92.6% and 72.5% respectively(20).

The next aspect of digital care that must be examined before moving on to telemedicine is Electronic Health Records (EESZT). Although not directly a part of telehealth, the changes to be discussed could not have happened without a system of EHR being in place. EESZT in Hungary was established in 2016 when the Ministry of Human Resources decree 39/2016 was passed. First it was public sector doctors and pharmacists who had to join as of 1 January 2017(85). The ambulance service was next on 1 November 2018 followed by private healthcare providers on 1 January 2020. As Varga et al. (2022) report, the pandemic accelerated both the use of EESZT and the services available on it. The number of procedures initiated by doctors on the system rose from 8.6 million in 2018 to 30 million in 2020. Besides increased volume of use, over 20 new features were introduced(86). According to Girasek et al. (2025) 87.4% of the respondent in their nation-wide representative sample heard of EESZT by 2024 and 77.2% actually used it(84).

The next decree discussed is relevant for online health related information seeking, but as it has a 24-hour, toll-free telephone line, it also offers teleconsultations with trained professionals. *1658/ 2020 (X.15) Governmental Decree on the establishment of a telephone and online information centre* has the potential to be a very significant innovation. As described by Döbrössy et al (2024) the centre is operated by the National Centre for Public Health and Pharmacy (Nemzeti Népegészségügyi és Gyógyszerészeti Központ) and it consists of a free telephone information service answered 7 days a week, 24 hours a day by trained dispatchers. They can deal with enquiries on COVID-19-related issues, health services and facilities, the use and functions of the EESZT, ePrescriptions, screening services, prevention, and health promotion(85). The centre also operates *egeszsegvonal.gov.hu* (roughly translated as 'health-line') where easy to understand information can be found about symptoms and illnesses. Döbrössy et al conclude in their

2022 systematic review of breast cancer related social media discourse that one possible solution to combating false and untrue information abundant on the internet would be the establishment of dedicated health related online hubs. Online hubs are digital platforms or websites that serve as a main access point for information, services, communication, or resources related to a specific topic(87). Egeszsegvonal.gov.hu is exactly such a hub. The fact that the centre provides a 7/24 telephone help-line is very important for elderly people who are more vary of searching for information online. The 2021 study of the Digital Health research Group of Semmelweis University reveals that while only 16.5% of the 18-64 age group say that they do not use the internet to search for information online , this is true for 49.2% of people aged 65–74 and almost 62.9% of people aged 75 and over (88). It is these people who can greatly benefit from this legislation.

4.1.1 Telemedicine

As mentioned previously, in 2020 there were only 9 OECD countries where law required doctors and patients to be in the same physical space for health care provision, and Hungary was one of them. This was so until the government passed the state of emergency *Government Decree no. 157/2020 (IV. 29.)* known as the Telemedicine Decree. Section 1 of this temporary decree says that: *'During the state of emergency declared by Government Decree 40/2020 (III. 11.) on the declaration of a state of emergency (hereinafter referred to as the "state of emergency"), in addition to the provisions of Section 9 (7) of Decree 60/2003 (X. 20.) of the Ministry of Health, Social and Family Affairs on the professional minimum requirements for providing healthcare services, the personal presence of the patient is not a prerequisite for the provision and financial settlement of healthcare services, provided that the nature of the care and professional medical judgment allow it*'(76). According to the decree, the following long-distance activities maybe done through ICT and telemonitoring tools: a) professional assessment of the patient's health condition, b) detection of diseases and their risks, c) identification of specific disease(s), d) ordering additional tests necessary for a more accurate assessment of the patient's condition and initiating treatment, e) determining the effectiveness of treatments as outlined in points a)–d) (teleconsultation), and f) monitoring the patient's condition and establishing a diagnosis. As can be seen, this is a very broad spectrum of medical interventions. According to the provisions of the decree, the below mentioned interventions may be carried out through telemedicine: a) patient management in the form of teleconsultation, as a foundation for specialist teleconsultation, b) receiving declarations regarding information consent, and data management, c) preliminary screening in the form of teleconsultation to assess whether personal meeting is required and the severity of the health condition, d) preliminary contact and data collection to make care based on a personal meeting following teleconsultation faster and more efficient, e) establishing a diagnosis or therapeutic recommendation through teleconsultation, or via telemonitoring or tele-diagnostic tools, f) prescribing medication, g) follow-up and aftercare following prior in-person care, h) organizing teleconsultations with multiple specialists, i) issuing referrals, j) psychotherapy, crisis intervention, parental consultation, counselling, supportive psychotherapy, k) physiotherapy using teleconsultation tools, l) breastfeeding counselling, m) health visitor care, and n) counselling or consultation conducted by telephone, online, or other forms of communication. Everything must be documented on EESZT. Should the patient's health status give reason for it, telemedicine must be terminated and in person care be resumed. It is the obligation of the doctor to decide whether a teleconsultation is suitable in the given case.

As the results of the Digital Health Research Group of Semmelweis University attest to it, the medical profession was ready for this legislation. By October 2021 36.6% of physician respondents had used teleconsultations and 47.5% intended to use it in the next 3 years. Only 13.4% of medical doctors had not heard about it by that time(89). In the 2021 survey it was found that primary care physicians were more aware then other physicians (90). 92.8% of primary care physicians had heard of it compared to 84% of non-primary care physicians. The age of the physician is also a factor in awareness of teleconsultations, having ever used it and intention of using it. Under 35 doctors were more familiar with this solution than 35-64 year old doctors, who in return were more aware of teleconsultations than doctors 65 and over. The same pattern arose in having ever used the technology and also in intention to use it (91).

The 33/2020 Decree of the Ministry of Human Resources (IX.16) on Telemedicine and Teleconsultations supplements Government Decree no. 157/2020. It states that the healthcare provider is obliged to have the IT equipment needed for the service provision. Besides the ICT tools themselves, the provider must be equipped with telemedicine guidelines and patient information sheets, broadband internet and virus protection. The decree lists telemedicine interventions that are reimbursed.

Finally, *"Government Decree 57/2021 on telemedicine enabling facial identification through video technology during the state of emergency."* was passed dealing with issues of cyber security. If it is the professional judgement of the provider that facial identification is required, this identification is permissible over ICT devices capable of transmitting images. The patient must identify themselves by their valid documents, which the physician must check using information in their database. In these cases, a telephone consultation may not be permitted but a skype or zoom session is allowed. These legislations were originally state of emergency legislations meaning they were valid only under the period of state of emergency declared during the Pandemic. This has been modified and each legislation and decree passed on telemedicine has been kept in effect.

The content of the degrees is incorporated into section 37 (Transitional Rules on Healthcare Matters) of Act No. LVIII of 2020 on *Transitional Rules Related to the Termination of the State of Danger and on Epidemic Preparedness,* this law is in affect today, so all the telehealth related legislation discussed above are binding to this day.

4.1.2 Financing issues

Primary care telemedicine use does not raise the question of finance as primary care physicians in Hungary are reimbursed on a capitation-based system. Primary health care providers are paid a fixed amount per patient per period. The issue of telemedicine finance becomes more important in outpatient specialist care where providers are reimbursed based on the number and type of services performed, using OENO codes and point values. Based on the *International Classification of Procedures in Medicine* published by the World Health Organization in 1978 (Geneva)(92), The OENO (Orvosi Eljárások Nemzetközi Osztályozása) is Hungary's official coding system for classifying medical procedures, in outpatient care. Each medical service is assigned a unique OENO code, which serves both administrative and financial purposes. The OENO codes of performed procedures are reported to the National Health Insurance Fund (NEAK), which then uses the associated point values of the codes to calculate reimbursement. The OENO codes and assigned point values are contained in the *Rulebook on the Application of the Outpatient Specialty Care Procedure Code List* updated periodically.(93) The following telemedicine related activities can be reimbursed according to the rulebook. The list is not exclusive. (The 5-digit number in brackets is the OENO code):

a.) *Follow-up or Consultation Outside Clinic or via Telemedicine* (11302) has a point value of 566. The point value of this intervention is higher than its face-to-face counterpart: *Follow-up Examination / Medical Consultation* (11301) which is only 354 points. This may be interpreted as policy driven incentive to promote telecare.

b.) *EEG with Telemetry* (12074), has a point value of 1127. *Standard EEG* (12070) (non-telemetric) is worth 1275 points. The difference here is not big.

c.) *ECG Monitoring* (89410), which is in-person, 'bedside' ECG, has only 182 points. *ECG with Telemetry* (12604) is worth 1752 points. *Trans-Telephonic ECG in Acute/Post-op/Emergency* (12607, 12608 and 12609 respectively) has a value of 3000 points each. *Trans-Telephonic ECG in Elective (non-urgent) Cases* (12609) is worth 1502. It can be assumed that it is the technological component which merits the higher reimbursement.

d.) One intervention where telemedicine is worth fewer points than in person care is *Documented Psychiatric Counselling via Telephone* (96003) valued at 113 points. According to the Rulebook this is psychiatric consultation initiated by the patient with their treating physician regarding symptoms, medication side effects, or life management issues. It includes crisis intervention, or suicide prevention. The physician documents the session. As such it may involve very high-skilled, complex interventions. This is much lower than the point value for in person *Crisis Intervention* (96002) which is 1157. It may be assumed that it is the simplicity of the technology involved, using a telephone, which reduces the value.

e.) *Dental Teleradiography* (31060) with 698 points is slightly higher than Dental Radiography (31040) at 597 points.

4.1.3 The future- digital health strategy in Hungary

The governments strategies relating to telemedicine are the following:

1. *The National Digitalization Strategy (NDS) 2022-2030* is an overall action plan that focuses on the increasing use of digitalization in all sectors, including the health sector. The following aspects are incorporated: digital skills, digital economy, and digital state. Digitalised public administration is treated as a priority. It involves: a.) synchronised, user-centred digital development of administrative and professional systems, b.) launching a data-driven administration, c) developing smart settlements and smart areas, d.) securing government electronic services, and e.) digitalising public services in healthcare, transport, energy, education, and culture. Digital health is an integral part of the digitalisation of public services.

2. *For a Healthy Hungary 2021-2027- Healthcare Sectoral Strategy of Ministry of Human Resources* contains strategies focusing on telemedicine use in healthcare. It is the first health sectorial strategy where telemedicine receives detailed attention. As an illustration of the confusion in terminology use discussed in the section on definitions, this action plan is called the eHealth action plan. It focuses on people-centred eHealth, regulated processes, data-based decisions, unification of system-level IT, digitalisation of the process of care provision, ePublic administration, support of eGovernance, and creation of the institutional system of eHealth.

3. *The National Health Informatics Strategy* was accepted by Governmental Decree 1455/2021. (VII. 13.). This decree is to improve healthcare through informatics, digitalisation, and AI. The 3 pillars are people-centeredness, digital transformation, and integrated care. Besides curative services it also talks about prevention, and health promotion. The decree specifically talks about the development of eHealth awareness, digitalising processes of care, health system management, telemedicine, and Big Data are the specific functions mentioned in the decree.

4.2 Survey pillar results

4.2.1 Demographic description of the samples

The survey, including sampling, was carries out by Ipsos Zrt. The samples are representative of the population with regards to gender, age, educational attainment and settlement type. In the 2021 survey representativeness is based on the 2016 Microcensus(94) and for the 2024 survey it is based on the 2022 census.(27) The demographic description of the sample can be seen in *table 1*.

Table 1 Demographic description of the surveys

Category	Subcategory	2021		2024	
		%	*n*	%	*n*
Gender	Male	46.6%	699	47.4%	474
	Female	53.4%	801	52.6%	526
Age Group	18–29 years	18.0%	270	16.0%	160
	30–39 years	19.7%	296	15.7%	157
	40–49 years	16.1%	242	19.9%	199
	50–59 years	17.8%	267	16.3%	163
	60 years or older	28.3%	425	32.1%	321
Education Level	Less than high school diploma	50.0%	750	42.5%	425
	High school diploma	32.0%	480	34.3%	343
	Higher education degree	18.0%	270	23.2%	232
Settlement Type	Budapest	18.1%	272	18.4%	184
	County capital / city with county rights	18.0%	270	17.9%	179
	Other towns	35.0%	525	35.8%	358
	Villages / rural municipalities	28.9%	434	27.9%	279
Number of children age less than 18 years	0	73,0%	1095	59,0%	590
	1	12,4%	185	26,4%	264
	2	10,4%	156	9,6%	96
	3 or more	3,9%	59	5,1%	51
Living alone or with partner	Lives alone	40,6%	610	33,9%	338
	Lives with a partner	59,30%	889	66,1%	661
Chronic disease	Yes	48,9%	732	57,7%	568
	No	51,1%	765	42,3%	417
Labour market status	Active	58,4%	876	56,2%	555
	Non-active	41,5%	623	43,8%	433

4.2.2. Distributions

Table 2 shows the main frequencies of telemedicine data. The p-values were calculated using Chi square test.

Table 2: past or current telemedicine use frequencies in 2021 and 2024

Service Type	2021		2024		
	%	*n*	%	*n*	*p-value*
Online appointment booking and referral requests	42.8%	642	69.8%	698	$p < 0.001$
Teleconsultation (by phone or video)	6.4%	96	14.2%	142	$p < 0.001$
Email communication with the doctor	24.0%	360	33.0%	330	$p = 0.035$
Sharing images with the doctor	8.1%	122	11.7%	117	Not significant
Sharing medical documentation with the doctor	18.9%	284	33.4%	334	$p < 0.001$
Doctor monitoring health status via smartphone	2.1%	32	7.5%	75	$p = 0.032$

The use of telemedicine solutions is higher in 2024 than in 2021. This was observed across all six telemedicine solutions, most remarkably in teleconsultations where the proportion of users nearly doubled. Despite this, teleconsultation use remains low. In 2024, nearly 70% of patients used online appointment booking, and more than 30% were in email communication with their doctors and shared medical documentation with them. At the same time, sharing images and telemonitoring remained relatively uncommon, used by only around 10% of patients in 2024.

In the next step, the Telemedicine Index was created based on the six variables: (a) online appointment booking and referral requests b) teleconsultations c) email communication with the doctor d) sharing images with the doctor e) sharing medical documentation with the doctor and f) allowing the doctor to monitor changes in health status via smartphone. They are all 0-1 dichotomous variables. The Telemedicine Index could have the values from 0-6, based on how many solutions the respondent used. This composite variable was calculated by summing the number of different telemedicine solutions used. The higher the index value, the more types of telemedicine solutions the respondent had used. Using the index captures telemedicine in its complexity and makes comparison easier. The mean number of telemedicine solutions used increased from 1.020 in 2021 (SD: 1.18) to 1.702 in 2024 (SD: 1.43).

Table 3 shows the Telemedicine Index frequencies by number of items used. A comparison of survey data from 2021 and 2024 shows a significant growth in the use of telemedicine services among respondents. In 2021, 56.5% of participants reported using at least one form of telemedicine, while 43.5% indicated that they did not use any such services. By 2024, the proportion of telemedicine users had risen to 79.0%, with only 21.0% reporting no telemedicine use. The change was found to be statistically significant, as confirmed by a Pearson chi-square test ($\chi^2(1) = 134.78$, $p < 0.001$) In 2024, around 11% of the population were ‘super-users’ using 4 or more solutions. In 2021 this was only 4.8%.

Table 3 Telemedicine Index frequencies in 2021 and 2024 according to Chi-square p<0,001

	2021		2024	
	%	*n*	%	*n*
0	43,5	653	21,0	210
1	28,7	431	30,1	301
2	15,4	231	25,2	252
3	7,6	113	12,6	126
4	3,7	55	5,7	57
5	1,1	16	2,9	29
6	0,0	0	2,4	24
Total	100,0	1500	100,0	1000

4.2.3 Multivariate analysis of variance

To continue the analysis of sociodemographic variables and telemedicine use, comparison of means using the F-statistic was utilised. Although the Telemedicine Index is not normally distributed, the sample was large enough to justify using the parametric F-statistic. Besides the parametric (F-tests) the non-parametric Mann-Whitney and Kruskal-Wallis p-values are also reported to compare robustness. *Table 4* displays the ANOVA findings from2021 and *Table 5* shows ANOVA from 2024.

Table 4 ANOVA 2021

		Mean	*N*	Std. Deviation	*F-test p-value*	*Mann-Whitney / Kruskall-Wallis test p-value*
Gender	Male	0,8913	699	1,11151	p<0,001	p<0,001
	Female	1,1409	801	1,23199		
Age groups	18-29 year old	1,2541	270	1,28325	p<0,001	p<0,001
	30-39 year old	1,2292	295	1,25121		
	40-49 year old	1,0550	242	1,19143		
	50-59 year old	1,0990	267	1,18516		
	60 year old or more	0,6723	425	0,96916		
Level of education	No school leaving exam (trade school or less)	0,7144	750	0,98811	p<0,001	p<0,001
	Secondary school with school leaving exam	1,1945	480	1,23056		
	University or college	1,5849	270	1,32546		
Type of settlement	Budapest	1,2659	271	1,25432	p<0,001	p<0,001
	County seat	1,0974	270	1,22222		
	Town	1,0684	526	1,25949		
	Village	0,7756	434	0,95713		
Living alone or with partner	Lives alone	0,8992	610	1,13503	p<0,001	p<0,001
	Lives with a partner	1,1094	889	1,20936		
Number of children age less than 18 years	0	0,9375	1095	1,13096	p<0,001	p<0,001
	1	1,1795	185	1,24440		
	2	1,2505	156	1,27051		
	3 or more	1,5711	59	1,44992		
Chronic disease	yes	1,0423	732	1,18860	p=0,589	p=0,536
	No	1,0092	765	1,18066		
Labour market status	Active	1,1254	876	1,20829	p<0,001	p<0,001
	Non-active	0,8852	623	1,13444		

Table 5 ANOVA 2024

		Mean	*N*	Std. Deviation	*F-test p-value*	*Mann-Whitney / Kruskall-Wallis test p-value*
Gender	Male	1,6559	474	*1,40657*	*p=0,333*	*p=0,337*
	Female	1,7440	526	*1,45857*		
Age groups	18-29 year old	1,9493	160	*1,51603*	*p=0,065*	*p=0,080*
	30-39 year old	1,8324	157	*1,60702*		
	40-49 year old	1,6453	199	*1,48900*		
	50-59 year old	1,5711	163	*1,38196*		
	60 year old or more	1,6172	321	*1,27447*		
Level of education	No school leaving exam (trade school or less)	1,4469	425	*1,38813*	*p<0,001*	*p<0,001*
	Secondary school with school leaving exam	1,8061	343	*1,43990*		
	University or college	2,0164	232	*1,43287*		
Type of settlement	Budapest	1,9338	184	*1,36802*	*p=0,002*	*p<0,001*
	County seat	1,9371	179	*1,54542*		
	Town	1,5748	358	*1,41083*		
	Village	1,5622	279	*1,40068*		
Living alone or with partner	Lives alone	1,4762	338	*1,39783*	*p<0,001*	*p<0,001*
	Lives with a partner	1,8194	660	*1,44070*		
Number of children age less than 18 years	0	1,5564	590	*1,29180*	*p=0,001*	*p=0,066*
	1	1,8762	264	*1,53042*		
	2	2,0128	96	*1,72475*		
	3 or more	1,9075	51	*1,69659*		
Chronic disease	yes	1,8217	568	*1,40615*	*p=0,004*	*p<0,001*
	No	1,5549	417	*1,44890*		
Labour market status	Active	1,8092	555	*1,47120*	*p=0,005*	*p=0,004*
	Non-active	1,5517	433	*1,35539*		

In 2021, women used telemedicine services at a significantly higher rate than men (Mean=1.14 vs. 0.89). By 2024, the situation changed: there was no significant difference between women and men in telemedicine usage (Mean=1.74 vs 1.66) This demographic gap is narrowing because telemedicine use is increasing at a higher rate among men than women.

In 2021, it is evident that the 60+ age group used telemedicine significantly less**,** while those under 40 used it significantly more (Mean= 0.67 vs. 1.23). In 2024, age differences diminished and are no longer significant (Mean=1.62 vs.1.83). A substantial change is that people over 60 used more than twice as many telemedicine solutions in 2024 than they did in 2021.

In 2021, the Telemedicine Index increased proportionally and linearly with education level. There is more than a twofold difference in the use of various telemedicine solutions between those with the lowest and highest levels of education (Mean=1.58 vs. 0.71). In 2024, there were still significant differences in the use of telemedicine solutions based on educational attainment. Although the gap between those with the lowest (Mean=1.44) and highest levels of education (Mean=2.02) narrowed compared to 2021, the difference remains statistically significant.

In 2021, the use of telemedicine solutions was significantly lower in smaller settlements (0.78) than towns (1.07), county seats (1.10) and Budapest (1.27). In 2024, the differences between settlement types decreased, but the advantage of Budapest and other large cities remains statistically significant.

In 2021, people living with a partner used significantly more telemedicine solutions compared to those living alone (Mean=1.11 vs. 0.90). In 2024 living with a partner further increased the use of telemedicine (Mean= 1.82 vs. 1.48).

In 2021, people with under 18-year-old children used significantly more telemedicine solutions. Mean telemedicine use for people with no children was 0.94 vs. 1.57 for people with 3 or more children. This persisted into 2024 as well, although all categories were using more telemedicine solutions. According to the Mann-Whitney test, the difference is not significant in 2024. Telemedicine growth among people childless people is faster than among people with a child or children.

In 2021, there was no significant difference in telemedicine use between individuals with chronic illnesses (Mean=1.04) and those without (Mean=1.01). In 2024, it is evident that individuals with chronic illnesses were using telemedicine solutions at a significantly higher rate (Mean=1.82 vs. 1.55).

In both 2021 and 2024 people whose labour market status was active used significantly more solutions than inactive people (in 2021 Mean=1.13 vs. 0.89 and in 2024 Mean= 1.81 vs. 1.55). People in any type of gainful employment were categorised as active. Full time students, pensioners, unemployed people and homemakers were termed inactive.

4.2.4 Analysis of perceived advantages and disadvantages of digital health technologies and telemedicine use

The perceived advantages and disadvantages of digital health technologies in 2021 and 2024 were quantified by adding up the number of advantages (maximum 11) and disadvantages (maximum 10) given by the respondents. In 2021, the perceived advantages (Mean = 7.64, SD = 3.01) outweighed the disadvantages (Mean = 5.63, SD = 2.72). In 2024 the perceived advantages (Mean= 7.38, S.D. = 3.49) did not change much but the perceived disadvantages were lower (Mean= 4.83, S.D. = 3.18). *Table 6* shows the correlations between perceived advantages and disadvantages of digital health and telemedicine use in 2021 and 2024.

Table 6 Correlations Between Perceived Advantages/Disadvantages of Digital Health and Telemedicine Use in 2021 and 2024

			How many advantages do digital health solutions have?	How many disadvantages do digital health solutions have?	telemedicina index
2021	How many advantages do digital health solutions have?	*Pearson Correlation*	--		
		N	1500		
	How many disadvantages do digital health solutions have?	*Pearson Correlation*	-,343**	--	
		Sig. (2-tailed)	0,000		
		N	1500	1500	
	telemedicine index	*Pearson Correlation*	,094**	-,082**	--
		Sig. (2-tailed)	0,000	0,001	
		N	1500	1500	1500
2024	How many advantages do digital health solutions have?	*Pearson Correlation*	--		
		N	1000		
	How many disadvantages do digital health solutions have?	*Pearson Correlation*	-,224**	--	
		Sig. (2-tailed)	0,000		
		N	1000	1000	
	telemedicine index	*Pearson Correlation*	,189**	0,007	--
		Sig. (2-tailed)	0,000	0,837	
		N	1000	1000	1000

**. Correlation is significant at the 0.01 level (2-tailed).

In both measurement periods, there was a statistically significant negative correlation between the perceived number of advantages and disadvantages (2021: $r = -0.343$, $p < 0.001$; 2024: $r = -0.224$, $p < 0.001$). This suggests that individuals who perceived more advantages tended to report fewer disadvantages. This negative association diminished somewhat between 2021 and 2024. The Telemedicine Index positively correlated with the number of perceived advantages in both years, with a weak but significant association in 2021 ($r = 0.094$, $p < 0.001$). This increased in strength by 2024 ($r = 0.189$, $p < 0.001$). On the other hand, the relationship between perceived disadvantages and the Telemedicine Index changed markedly over the observed period. In 2021, there was a small but significant negative correlation ($r = -0.082$, $p = 0.001$), denoting that those reporting more disadvantages used telemedicine less. However, by 2024, this relationship was no longer statistically significant ($r = 0.007$, $p = 0.837$).

4.2.5 Telemedicine Index and demographic factors in multivariate analysis

To examine the constructed Telemedicine Index, a multinomial logistic regression model was used, with the Telemedicine Index as the dependent variable. Besides the socio-demographic variables of gender, age, settlement type, highest educational level, and labour market status, additional factors included were family status (living alone or with a partner), number of children under 18, perceived advantages of digital health solutions, and chronic illness status.

As the index was not normally distributed, it was recoded into a three-category variable: 0 (no use), 1–2 (moderate use), and 3+ (high use). The analysis used the 0 category as the reference. For the 2021 data, the model explains 17.7% of the variance (Nagelkerke R^2 = 0.177). This is acceptable in social science research.

For moderate telemedicine use (index = 1–2), the following factors showed significant associations for the 2021 data:

- Age: (OR = 0.984) older individuals were less likely to use telemedicine moderately.
- Gender: (OR = 0.752) males were less likely to use 1–2 solutions compared to females.
- Chronic illness: (OR = 1.569) having a chronic illness increased the odds of moderate use.
- Settlement type: Compared to villages, living in Budapest increased the likelihood of telemedicine use (OR = 1.48).
- Education: Compared to those with college or university education, individuals without a secondary school leaving exam were less likely to use telemedicine (OR = 0.429).

For high use (index = 3+), significant predictors were the following:

- Age: (OR =0.968) telemedicine use decreased with age.
- Gender: (OR = 0.455) males were less likely to be high users.
- Perceived advantages of digital health (OR = 1.104) are positively associated with high usage.
- Number of children: (OR = 1.39) having more children correlated with higher use.
- Chronic illness (OR = 2.095) strongly increased the likelihood of high use.
- Settlement type: Compared to villages larger settlement have higher OR for telemedicine use:
    - Other towns: OR = 2.39
    - County seats: OR = 2.122
    - Budapest: OR = 3.062

- Education: Compared to university or college education those with secondary education (OR = 0.432) and less than secondary education (OR = 0.178) show significantly lower odds of telemedicine use.

The full regression data for 2021 is shown in T*able 7*.

Table 7 Regression 2021(significant results are highlighted)

Multinominal logistic regression, Nagelkerke R-square = 0,177									
								95% Confidence	
elemedicine_index_3cat Telemedicine index 3 categories		B	Std. Error	Wald	df	Sig.	Exp(B)	Lower Bound	Upper Bound
ıoderate use (1or 2)	Intercept	1,064	0,393	7,315	1	0,007			
	Age	-0,016	0,004	16,474	1	0,000	0,984	0,976	0,992
	Gender:Male	-0,285	0,119	5,732	1	0,017	0,752	0,595	0,950
	Gender:Female	0^b			0				
	How many advantages do digital health solutions?	0,029	0,020	2,055	1	0,152	1,029	0,989	1,070
	How many disadvantages do digital health solutions?	-0,007	0,023	0,109	1	0,741	0,993	0,950	1,037
	Number of children under 18	0,044	0,073	0,356	1	0,551	1,045	0,905	1,206
	Family status: lives alone	-0,201	0,122	2,685	1	0,101	0,818	0,644	1,040
	Family status: lives with a partner	0^b			0				
	Do you have chronic illness: yes	0,450	0,128	12,414	1	0,000	1,569	1,221	2,016
	Do you have chronic illness:no	0^b			0				
	Type of settlement: Budapest	0,392	0,181	4,684	1	0,030	1,480	1,038	2,110
	Type of settlement: county seat	0,022	0,174	0,016	1	0,901	1,022	0,727	1,437
	Type of settlement: town	-0,022	0,142	0,024	1	0,877	0,978	0,740	1,293
	Type of settlement: village	0^b			0				
	Level of education: no secondary school leaving exam	-0,824	0,179	21,285	1	0,000	0,439	0,309	0,622
	Level of education: secondary school leaving exam	-0,348	0,186	3,521	1	0,061	0,706	0,491	1,016
	Level of education: college or university	0^b			0				
	Labour market status: active	0,113	0,137	0,679	1	0,410	1,120	0,856	1,465
	Labour market status: inactive	0^b			0				
higher use (3+)	Intercept	-0,120	0,622	0,037	1	0,847			
	Age	-0,033	0,007	25,595	1	0,000	0,968	0,955	0,980
	Gender: male	-0,787	0,192	16,812	1	0,000	0,455	0,312	0,663
	Gender: female	0^b			0				
	How many advantages do digital health solutions?	0,099	0,037	7,128	1	0,008	1,104	1,027	1,188
	How many disadvantages do digital health solutions?	-0,052	0,037	2,010	1	0,156	0,949	0,884	1,020
	Number of children under 18	0,329	0,095	11,878	1	0,001	1,390	1,152	1,676
	Family status: lives with a partner	-0,334	0,202	2,728	1	0,099	0,716	0,481	1,064
	Family status: lives alone	0^b			0				
	Do you have chronic illness: yes	0,739	0,196	14,261	1	0,000	2,095	1,427	3,074
	[Do you have chronic illness: no	0^b			0				
	Type of settlement: Budapest	1,119	0,301	13,780	1	0,000	3,062	1,696	5,529
	Type of settlement: county seat	0,752	0,304	6,129	1	0,013	2,122	1,170	3,849
	Type of settlement: town	0,871	0,262	11,088	1	0,001	2,390	1,431	3,992
	Type of settlement: village	0^b			0				
	Level of education: no secondary school leaving exam	-1,728	0,253	46,788	1	0,000	0,178	0,108	0,291
	Level of education: secondary school leaving exam	-0,839	0,238	12,413	1	0,000	0,432	0,271	0,689
	Level of edication: College or university	0^b			0				
	Labour market status: active	0,291	0,210	1,912	1	0,167	1,337	0,886	2,019
	Labour market status: inactive	0^b			0				
	a. The reference category is: ,00 0.								
	b. This parameter is set to zero because it is redundant.								

A similar multinomial logistic regression model was constructed using the 2024 dataset. The model explains 13.3% of the variance (Nagelkerke $R^2 = 0.133$). This is within the acceptable range for social science research.

For moderate telemedicine use (index = 1–2), the variables below were significant:

- Living without a partner (OR = 0.559) is associated with a lower likelihood of moderate use.
- Chronic illness (OR = 1.553) is positively associated with usage.
- Education: Compared to those with university or college education, individuals without a secondary school leaving exam were significantly less likely to use telemedicine tools (OR = 0.512).

For high telemedicine use (index = 3+), significant predictors included:

- Gender: (OR = 0.621) Males have a decreased likelihood of high use.
- Perceived advantages of digital health (OR = 1.132) is positively associated with telemedicine use.
- Living alone (OR = 0.442) decreases the odds of high usage.
- Chronic illness (OR = 2.370) is strongly associated with increased usage.
- Settlement type: Compared to villages living in larger settlements has higher OR of telemedicine use:
    - County seat: OR = 2.133
    - Capital city: OR = 2.379
- Education: Relative to university or college education less than secondary education showed significantly lower odds (OR = 0.234).
- Labour market status: being economically active increased the likelihood of high telemedicine use (OR = 1.583).

Table 8 presents the full regression results for 2024, with significant values highlighted.

Table 8 Regression 2024 (significant results are highlighted)

Multinominal logistic regression, Nagelkerke R-square = 0,133									
								95% Confidence	
Telemedicine _index_3cat Telemedicine index 3 categories[a]		B	Std. Error	Wald	df	Sig.	Exp(B)	Lower Bound	Upper Bound
Moderate use (1 or 2)	Intercept	0,845	0,495	2,917	1	0,088			
	Age	-0,001	0,006	0,046	1	0,830	0,999	0,987	1,011
	Gender: Male	-0,299	0,183	2,659	1	0,103	0,742	0,518	1,062
	Gender: Female	0[b]			0				
	How many adavantages do digital health solutions have?	0,043	0,024	3,086	1	0,079	1,044	0,995	1,095
	How many disadavantages do digital health solutions have?	0,025	0,027	0,863	1	0,353	1,026	0,972	1,082
	Number of children under 18	0,095	0,107	0,780	1	0,377	1,099	0,891	1,357
	family status: lives alone	-0,582	0,180	10,517	1	0,001	0,559	0,393	0,794
	Family status: lives with a partner	0[b]			0				
	Do you have chronic illness: yes	0,440	0,183	5,773	1	0,016	1,553	1,084	2,223
	Do you have chronic illness: no	0[b]			0				
	Type of settlement: Budapest	0,451	0,275	2,679	1	0,102	1,569	0,915	2,691
	Type of settlement: county seat	0,291	0,274	1,134	1	0,287	1,338	0,783	2,288
	Type of settlement: town	-0,099	0,208	0,225	1	0,635	0,906	0,603	1,362
	Type of settlement: village	0[b]			0				
	Level of education: no secondary school leaving exam	-0,670	0,240	7,808	1	0,005	0,512	0,320	0,819
	Level of education: secondary school leaving exam	0,068	0,257	0,071	1	0,790	1,071	0,647	1,771
	Level of education: college or university	0[b]			0				
	Labour market status active	0,177	0,188	0,881	1	0,348	1,193	0,825	1,726
	Labour market status inactive	0[b]			0				
Higher use (3+)	Intercept	-0,269	0,605	0,198	1	0,656			
	Age	-0,012	0,007	2,772	1	0,096	0,988	0,974	1,002
	Gender: male	-0,477	0,220	4,688	1	0,030	0,621	0,403	0,956
	Gender: female	0[b]			0				
	How many advantages do digital health solutions have?	0,124	0,032	15,126	1	0,000	1,132	1,063	1,205
	How many disadavantages do digital health solutions have?	0,025	0,034	0,542	1	0,462	1,025	0,960	1,095
	Number of children under 18	0,188	0,123	2,323	1	0,127	1,206	0,948	1,535
	family status: lives alone	-0,817	0,224	13,332	1	0,000	0,442	0,285	0,685
	Family status: lives with a partner	0[b]			0				
	Do you have chronic illness: yes	0,863	0,225	14,729	1	0,000	2,370	1,525	3,682
	Do you have chronic illness: no]	0[b]			0				
	Type of settlement: Budapest	0,867	0,325	7,093	1	0,008	2,379	1,257	4,502
	Type of settlement: county seat	0,757	0,323	5,488	1	0,019	2,133	1,132	4,019
	Type of settlement: town	0,088	0,262	0,114	1	0,736	1,092	0,654	1,825
	Type of settlement: village	0[b]			0				
	Level of education: no secondary school leaving exam	-1,452	0,280	26,909	1	0,000	0,234	0,135	0,405
	Level of education: secondary school leaving exam	-0,286	0,285	1,003	1	0,317	0,751	0,429	1,315
	Level of education: college or university	0[b]			0				
	Labour market status: active	0,459	0,231	3,958	1	0,047	1,583	1,007	2,489
	Labour market status: inactive	0[b]			0				

a. The reference category is: ,00 0.

b. This parameter is set to zero because it is redundant.

5. Discussion

5.1 The significance of COVID-19 at the time of data collection

In interpreting the results, it helps to be aware of the COVID-19 situation at the data collection periods as it may have bearings on the telemedicine usage behaviour at the time. The first data collection took place between 5-13 October 2021. It was in the fourth wave of the pandemic. The number of new cases reported varied between 294 and 837 that week, but went up to 4039 by the end of the month (95). Although over 5 million people had been vaccinated by that time in Hungary, there was debate about whether the vaccine would be effective against the new Delta variant (96). There were no activity restrictions imposed but COVID-19 was still very much on the minds of people. According to Google Trends, the most common Google searches in Hungary in 2021included the Oxford AstraZeneca vaccine, the number of people vaccinated, and vaccine registration(97). The second data collection period was between 12 -22 February 2024. By this time COVID-19 had very little impact on people's daily life. Media actually stated that the then current variant, JN.1, was nothing to worry about (98).

5.2 Telemedicine in the broader context of digital health

This thesis focused strictly on telemedicine. The previous studies of the Digital Health Research Group at Semmelweis University looked at digital health in the broader context including eHealth, meaning information and communication technology use for health (mostly online information seeking), and mHealth, meaning mobile technology use for health. The present findings on telemedicine fit into the pattern observed in the previous studies of the Research Group. Girasek et al (2025) looked at online health related information searches, the use of health monitoring sensors and mobile devices and telemedicine in 2021 and 2024 and found that the frequency and method of searching for health information online changed significantly(84). The number of internet users not conducting health related online searches was higher in 2021 (12.4%) than in 2024 (8%). The number of people searching for health-related information before and/or after going to the doctor went up from 45.7% to 67.9%. This indicates that online health information searching is not an alternative to going to the doctor but a supplement to it. Legislation, most notably the establishment of the previously mentioned *egeszsegvonal*, the 24-hour telephone and online information centre, plays a vital role here, too as online sources of quality assured, reliable information are vital. Döbrössy at al. (2020) observe that the volume of health related social media discourse is considerable(87). Most participants in the online discussions are lay individuals, not healthcare professionals. Lay misunderstandings abound on the internet. Their study concludes that one possible solution to combat false and untrue information would be the establishment of dedicated health related websites (such as egeszsegvonal.gov.hu) operated by health authorities. This would ensure much needed quality-controlled information and provide a site for reliable question and answer forums. In addition, as this centre offers a '24/7' free call centre, it is an essential telemedicine consultation opportunity, too.

5.3 Interpreting the results of the policy pillar

The first hypothesis stated that before March 2020, the legal framework in Hungary was fragmented and not ready for telemedicine use. This was supported by evidence from the present study. Digital readiness in Hungarian healthcare was minimal. The EESZT was the main legally regulated digital tool available, but familiarity with it was low. Hungary was one of the nine OECD countries where teleconsultations were not legally allowed. As Győrffy and Döbrössy stated in their 2024 study, from a regulatory point of view Hungary was in a state of unreadiness for the use of digital technologies in healthcare(99).

Hypothesis 2 stated that COVID-19 accelerated not only telemedicine use but regulatory governmental activities as well. As one of the rare positive side effects of the pandemic, the quick legal regulation of telemedicine brought what is legally possible to the level of what is technologically feasible. Telemedicine use increased during the pandemic, and this was made possible by a quick succession of regulations(1). To use a metaphor, policy makers in Hungary did a good job of fixing the airplane while flying it. In a span of 11 months of legislative activity the current state of rather advanced legal regulatory framework was shaped to facilitate telemedicine use. This includes *Act No. LVIII of 2020 on Transitional Rules Related to the Termination of the State of Danger and on Epidemic Preparedness, Section 37: Transitional Rules on Healthcare Matters* which extends the legal regulation beyond the emergency period and governs telemedicine use today. From a situation when non personal healthcare was illegal in March 2020 within a length of a few months one could send a photo of a rash and receive expert medical advice and prescriptions online and the health care providers was reimbursed for this activity by the financer.

Hypothesis 3 stated that the post-pandemic health care strategy pays more attention to telemedicine than in the pre-COVID-19 era. As discussed in the policy results section, the National Health Informatics Strategy of July 2021 has a section on eHealth. This is the first time issues of digital health were addressed in health sectorial policy. *The National Digitalisation Strategy* and the *For a Healthy Hungary 2021-2027* health sectorial strategy both emphasize the importance of eGovernance. Vital to this is the promotion of the *Egészségablak* app which facilitates online appointment booking, medical document access, patient feedback, and knowledge base among other features. According to Sensoertower.com, this application had been downloaded 3.5 million times by April, 2024(100). The Budapest Business Journal quotes Secretary of State Bence Rétvári as saying that *egészségablak* has 3 Million monthly users(101).

Finally, hypothesis 4 stated that rapid policy making activities facilitated use of telemedicine in Hungarian healthcare settings. An upswing in telemedicine use was clearly observed by this study, which wouldn't have been possible without the legislative activity discussed. Because legislation also covers the issue of reimbursement for providing teleservices, doctors are much more willing to take part in it. The legislative activity had an impact on telemedicine use in Hungary but did not reach its full potential. This is especially true for teleconsultations which were still only practiced by 14.2% of the population in 2024. Evidence was provided in the introduction about the benefits of telemedicine. It may make healthcare provision and reception more comfortable, save travelling time, and ease issues caused by a shortage of healthcare providers. With its use, quality care can be provided in underserved geographical areas. A demand was voiced from the physicians' side that health-care facilities which only provide services in the online sphere should be allowed to exist as well. This would save operational costs(102). This type of service may be very favourable for the providers and hence may help establish stronger telemedicine presence in Hungary. In their article published online on *portfolio.hu* Kovácsy argues that the pandemic-era reforms placed all responsibility on doctors and healthcare providers to judge whether a service can be delivered remotely and to ensure compliant data handling. Doctors received little methodological or practical support. For instance, as Kovácsy argues in 2025, there is still no guidance on how to give obligatory data protection notices via video calls(102). Telemedicine related guidelines and protocols are very much needed. An example of one such greatly needed guideline for medical practitioners is the one offered by Péter (2021) in her detailed guideline involving issues of confidentiality raised by digitalisation(103).

5.3.1 Where does Hungarian digital health policy stand in international comparison?

It is difficult to compare the state of telemedicine in various countries. Any pre-COVID-19 comparison is meaningless as COVID-19 completely rewrote the script. Other international comparative data may be up to date, but do not have country level breakdown. The WHO publication *The Ongoing Journey to Commitment and Transformation of Digital Health in the WHO European Region 2023* is a good example of this(104). There are some good studies that cannot be used as Hungary is not included in them. See for example SmartHealthSystems: *International Comparison of Digital Strategies*(66).

One up-to-date source that can be used as it has country level data on nations including Hungary is the Global Digital Health Index (GDHI)(105). It provides data on the digital health environment based on an online survey completed by the national ministries of health. It uses the WHO International Telecommunication Union National eHealth Strategy Toolkit. The latest data collection was in 2023. Leadership and governance, strategy and investment, legislation, strategy and compliance, workforce, standards and interoperability, infrastructure, services, and applications are the aspects of digital health policy measured. The data for Hungary is rather incomplete(85). The reason for this is unknown. Data is only available for leadership and governance, legislation, policy, and compliance. Scoring is through developmental phases from 1 to 5, where 5 means the most developed phase and 1 is the least. Hungary is in overall developmental phase 4 which is the EU average. For leadership and governance Hungary is in Phase 4, This is the global average. Legal framework for data protection is in Phase 5, 1 unit over the global average. For the sub-indicator of laws or regulations for privacy, consent, confidentiality, and access to health information (privacy) Hungary is in Phase 3 (but here, this is the global average). For the dimension of infrastructure, planning and support for ongoing digital health infrastructure maintenance is in phase 5, 1 more than the global average. For digital health infrastructure the country is at the global average of 4.

5.4 Interpreting the survey results

The first hypothesis, that the frequency of telemedicine use would be significantly higher in 2024 than in 2021, was supported by the results. This is in line with the studies reviewed in the introduction section. The higher volume of use suggests that telemedicine solutions have become a more integrated part of everyday healthcare. Especially notable is the spread of online appointment booking (from 42.8% to 69.8%) and sharing medical documents online (from 18.9% to 33.4%). Although the use of teleconsultations was also significantly higher (from 6.4% to 14.2%), its overall prevalence remains relatively low. The biggest difference is in the shrinking of the number of people who don't use any telemedicine. These results agree with the studies presented in the literature review section. All of them indicated an increase in telemedicine use at the start of the pandemic that tailed off with time but remained higher than the pre-pandemic period. (37, 41, 48, 54, 57) The 2023 OECD report on the COVID-19 Pandemic and the future of telemedicine also reported massive increase in telemedicine use among member states (1).

Hypothesis 2 stated that the average value of the Telemedicine Index would be significantly higher in 2024 than in 2021. This is supported by the evidence. The mean Telemedicine Index went up from 1.02 in 2021 to 1.70 in 2024. The data indicates a wider spread of telemedicine solutions. Based on the Telemedicine Index 43.5% of respondents did not use any such solutions in 2021. This was only 21% in 2024. The proportion of those using three or more solutions more than doubled in the 3 years. This trend suggests that more people are making use of a variety of digital solutions to access health care. This result may partly be attributed to governmental efforts outlined in the '*For a Healthy Hungary 2021-2027'*. Most notable is the widespread promotion of the *'egészségablak'* app which has online appointment booking functions as well as easy access to the EESZT.

Hypothesis 3 stated that demographic differences would decrease between 2021 and 2024 in the use of telemedicine solutions. This is supported by the results in the case of gender and age. The regression analysis found that gender was significant for moderate and high use in 2021, but it was only significant for high use in 2024. The OR for males in 2021 is 0.455 and in 2024 it is 0.621. So even among high users the difference is diminishing. The ANOVA results support this. In 2021 women used telemedicine services at a significantly higher rate than men. The 2024 ANOVA analysis showed no significant difference between women and men in telemedicine usage. Gender-based differences have declined, indicating increasing male adoption and a move toward gender parity. This is not only so for telemedicine but for the whole spectrum of digital health solutions as revealed in Győrffy et al.(106). In 2021, women made greater use of digital health tools, particularly e-prescriptions and telemedicine, while men were more likely to use apps to monitor their health. The present findings are also consistent with the international research discussed in the introduction (51, 52, 58). Telemedicine use increased for both men and women, but for men the increase was greater, so they caught up to women.

Age-related differences also decreased. The regression analysis showed that age was significant for moderate and high use in 21 but it was no longer significant in 24. Age differences have also diminished according to the ANOVA results: in 2021 individuals aged 60+ used telemedicine significantly less, while those under 40 used it significantly more. By 2024 age-based differences diminished and were no longer statistically significant. Age-based disparities in telemedicine use have equalized over time, largely due to a substantial increase in usage among older adults. There is international evidence, too. While individuals over 60 used telemedicine significantly less than younger people in 2021, (43, 50, 54, 65) they had an accelerated increase in use diminishing the age differences. Interestingly, Hung et al.'s 2022 study found higher telemedicine use among the 80+ respondents than among the 18-29 age group. This may be due to the greatly increased health care needs of elderly people(48). Haimi et al. (2024) looked at telemedicine use among Israelis aged 65 and older before, during, and after the COVID-19 pandemic(107) and found that telemedicine use increased greatly during the pandemic and remained higher than pre-pandemic levels afterward. Because elderly people can use telemedicine services, it can be an alternative to assisted living and nursing homes.

Differences by educational attainment remain significant. Regression showed that university or college educated people consistently have a significantly higher Odds Ratio of using telemedicine than people who do not have a secondary school leaving exam. This was so in 2021 and 2024 for both moderate and high users. The ANOVA results support this. In 2021 telemedicine use increased proportionally and linearly with education level. A more than twofold difference was observed between those with the lowest and highest levels of education. Significant differences based on educational attainment persist in 2024. Education remains a strong and persistent predictor of telemedicine use.

Regression and ANOVA analysis both supported that urban-rural differences in telemedicine use have decreased but remain significant, especially favouring Budapest. The observations that lower educated people and people living in rural areas used telemedicine less is very much supported by the literature (45, 46, 51-54, 59, 65).

Labour market status remained significant in 2024. According to the ANOVA results individuals in the active labour market status used significantly more telemedicine solutions than those who were inactive in both years. Regression however only showed significant OR ratio favouring higher telemedicine use in 2024.

Hypothesis 4 was that social and family support positively influences the use of telemedicine solutions at both time points. This is supported by the ANOVA results: individuals living with a partner used significantly more telemedicine solutions than those living alone in both 2021 and 2024. The regression analysis also attests to it. People living alone have significantly lower Odds Ratio than people living with a partner for both moderate and high use in 2024. The results demonstrate the positive role of social support on telemedicine use. Although this is an under-researched area, there is support for it from other studies. Rahman et al. (2023) found a positive association between social support and telemedicine use(108). In their 2021 US study on people aged 70 and over Chung el al. found that living with family or friends and receiving technical support were associated with higher telehealth utilization(109). The importance of social support is also highlighted by the research on ePatients in Hungary of the Digital Health Research Group at Semmelweis

University. Among individuals aged 65–74, 21.3% reported having someone help them in finding online health information. This number goes up to 35.4% for those aged 75 and older, while only 3.0% of people aged 18–64 reported needing such assistance(88). Women not only tended to search for health-related information online more frequently, but they were also more likely to seek help from others when doing so. Non-internet users were not left without help either in getting health related information. According to Girasek et al. (2022) almost half of them (48.2%) were helped by a friend or family member in finding health related information online (20). As Győrffy et al. state in their 2023 analysis, the integration of seniors in the digital health era is vital(88). Their research demonstrated that elderly people are interested in using digital devices for health. More than a fifth of older adults would have liked to have access to between 7 and 10 of the maximum number of digital devices available. The interest is there, what is needed is help. This is supported by Boros et al (2023) who found that 70% of the elderly would like to try digital technologies. So although they used fewer digital health solutions, the interest was there even in 2021(110). By 2024, this manifested into significantly higher telemedicine use. Recognising that elderly people need support for internet use, the National Media and Info-communications Authority launched the 'Netre Fel' (this word-play may be translated as 'ride the net') initiative containing a guide to internet use tailored for elderly people. What is more important, they can ask for help online and can be also put in touch with 'super-helper' volunteers (111).

An example of the importance of peer support in telemedicine use among another special needs population is given by Radó et al. in their 2024 study on people experiencing homelessness (112). They identified the existence of a significant digitally engaged group among homeless people. Over half of this digitally skilled group served as informal digital supporters for their peers, helping with problem-solving and basic digital literacy. This lay support network can potentially be very significant in helping digitally with the health care needs of people experiencing homelessness.

Finally, it is worth remembering that social support is also available online for those who can access it. Döbrössy et al.'s 2020 systematic review of studies on breast cancer discourse on social media found evidence of peer social support offered on social media encouraging others to participate in breast cancer screening. The same review found evidence for the utility of online patient communities positively influencing health and illness behaviour. Once one is digitally literate enough to access social media, help can be found in further health related online activity(87).

Hypothesis 5 stated that among individuals with chronic illnesses the use of telemedicine solutions would significantly increase between 2021 and 2024, and in 2024 chronically ill people would use these solutions more frequently than those without chronic illnesses. In the regression analysis having chronic illness has one of the highest ORs for high use in 2021 and 2024, too. In both years it is also a significant predictor for moderate, use, too. ANOVA results lend support: although in 2021 there was no significant difference in telemedicine use between individuals with or without chronic illnesses in 2024 individuals with chronic illnesses used telemedicine solutions at a significantly higher rate. Chronic illness is the most consistent and strongest predictor of telemedicine use, especially in 2024, when both statistical methods aligned. Numerous studies indicate that telemedicine is increasingly seen as a vital component in managing chronic conditions. Zaganjor et al. analysed data from the 2022 U.S. National Health Interview Survey to assess telemedicine usage among American adults categorized by diabetes status and found that people with diabetes and pre-diabetes use more telemedicine than those without it (46). Bhatla et al.'s 2022 U.S. study found that people with cardiovascular disease (CVD) were more likely to use telemedicine compared to those without CVD or associated risk factors(47).

Hypothesis 6 postulated that people who perceive more advantages in telemedicine solutions would use them more intensively. Public perception of digital health technologies in 2024 was slightly more favourable than in 2021. This was not because people saw more benefits, but because they saw fewer disadvantages. Although positive telemedicine related attitudes didn't change much, their correlation with telemedicine use increased. Pearsons correlation showed that the Telemedicine Index positively correlated with the number of perceived advantages in both years, with a weak but statistically significant association observed in 2021 which increased in strength by 2024. Seeing advantages in digital health also had a significantly higher OR in 2024 among higher users. By 2024 using telemedicine was a choice, influenced by preferences. In the 4th wave of the pandemic in 2021, it was still more of a necessity.

5.5 Comparing digital and non-digital illness behaviour

Mechanic's *illness behaviour* is a core concept in medical sociology. It refers to the actions undertaken by individuals when feeling ill, including seeking medical care, pursuing alternative treatment, or self-medicating themselves (113). As described by Döbrössy (2020) it is a complex behaviour partly influenced by medical need, but also by health literacy, culture, education, norms and resources(114). Digital illness-behaviour is the same concept, except it takes place in the digital sphere. As was seen, it is also influenced by sociodemographic factors. In what follows the results of the present study will be compared to data on sociodemographic factors and health care utilization to shed light on the differences of illness behaviour and digital illness behaviour. The following set of data concerning demographic patterns in health care utilisation is from the latest (2019) wave of the European Population Health Interview Survey concerning Hungary (115). The next wave of the survey is due in 2025, so no post pandemic data is available yet. Although the data is six years old its use is justifiable as socio-demographic patterns in health-care utilisation are relative stable throughout the last three waves of the survey. The results from 2009, 2014 and 2019 show the same socio-demographic trends in health care utilisation patterns (115).

Women utilize healthcare services more frequently than men. In the 12 months before the study, 81.7% of women and 73.1% of men saw a primary care provider, while 73.2% of women and 68.3% of men saw a specialist. This gender gap is also present in telemedicine use. It significantly favoured women in 2021, but narrowed and lost significance by 2024.

Healthcare utilization increases with age. Primary care visits were reported by 70.5% of 18–34-year-olds, 74.9% of those aged 35–64, and 91% of those 65 and older. Specialist visits followed a similar pattern. In contrast, younger individuals were more likely to use telemedicine in 2021. By 2024 older adults had significantly increased their digital healthcare use, reducing the digital divide. Nevertheless, online and offline healthcare behaviour remain distinct.

Primary care visit rates are similar across education levels: 78% for those with primary or secondary education, and slightly lower (74.7%) for university graduates. However, education-related differences are more pronounced for specialist visits. 68.7% among university-educated individuals versus 56.9% for those with only primary education. Telemedicine use mirrors the pattern observed in specialist visits, with significantly higher rates among those with a university degree or high school diploma. This highlights a digital paradox. As described by Győrffy et al. people with greater healthcare needs—older adults and less-educated individuals—use telemedicine the least, despite potentially benefiting the most (88).

Primary care visits differ little by settlement type. GP visit rates are nearly identical in Budapest (75.9%) and villages (75.7%), and are close in county seats (79.9%) and towns (79.1%). In contrast, specialist care reveals clearer regional disparities: utilisation is highest in Budapest (70.4%), followed by county seats (65.3%), towns (63.4%), and villages (57.6%). Telemedicine usage mirrors specialist care patterns in both 2021 and 2024. It is significantly higher in Budapest and county seats compared to towns and villages. These differences reflect disparities in availability rather than need, as specialist services are more accessible in urban areas, while primary care is relatively easy to reach even in smaller settlements.

The urban-rural divide is evident not only in specialist health care use but in levels of digital literacy, too. The 2022 census provides evidence of geographical differences in the level of digital activity people undertake(27). 83% of the population regularly engage in digital activities, with 53% of the population performing higher-level tasks such as online administration and shopping. People who are able to participate in these activities are defined as having intermediate digital literacy. This group is concentrated in Budapest, Pest county and larger cities and least present in villages. According to the 2022 census, low or minimal digital literacy is more frequent in villages.(27) Limited use of teleconsultation in villages thus reflects broader patterns observed in differences in digital activity levels.

As stated by Győrffy et al (2023), digital health solutions could alleviate the health care needs of vulnerable populations by easing access to quality services. As we have seen, there are barriers that limit telemedicine use for certain individuals. Our results show that two such vulnerable populations are people living in smaller settlements and people who are less educated. These are the groups where differences in telemedicine use remained significant in 2024(116). Having recognised this, policy makers emphasise the need to improve the digital literacy of the population. Improving digital skills is a priority area of the *National Digitalisation Strategy 2022-2027* as discussed by Döbrössy et al (2024)(18).

5.6 Telemedicine from the providers' point of view

Before reaching a conclusion, it is worth looking at telemedicine use from the providers' point of view. Between July 2021 and May 2022, the Digital Health Research Group at Semmelweis University conducted an online questionnaire survey among doctors working in Hungary.(89) A total of 415 General Practitioners (GPs) completed the questionnaire. Key findings show that 83.7% believe patients would like to communicate via e-mail. This is far higher than the 33% of patients who reported doing so in the 2024 general population survey. While 86.4% of GPs are aware of teleconsultations, 47.5% wish to use them intensively in the next three years, compared to just 14.2% of patients who have reported using it in the present study. Similarly, 49.0% of GPs expressed interest in using tele-sensors, exceeding the current patient usage rate of 7.5% reported in this thesis. As the Digital Health Research Group at Semmelweis University note in their 2024 publication analysing the results of the same survey, GPs are more open to telemedicine use with patients while showing less interest in technologies that support clinical work (90).

6. Conclusions

This thesis aimed to understand changes in telemedicine use in Hungary in 2021 and 2024 within the framework of the telemedicine related legal-regulatory environment. It consisted of two separate pillars: a policy pillar which examined the evolution of telemedicine related regulation in Hungary and a survey pillar which analysed two large scale, representative surveys exploring sociodemographic patterns in telemedicine use in 2021 and 2024. There is international evidence that digital health solutions may lead to more equitable and efficient healthcare so it is important to learn who uses these solutions and what can be done to facilitate the telemedicine use among people who are lagging behind in this respect (17).

Regarding the telemedicine regulatory framework, it is safe to conclude that decision-makers reacted well to the challenges posed by COVID-19. From a pre-COVID-19 situation in which no telemedicine strategy existed and online teleconsultations were not allowed within a few short months decrees and laws had been passed which created the legal environment for the operation of a 21-century telemedicine system which fares well in international comparison. This accelerated doctors' and patients' cultural acceptance of tele-solutions. Besides the laws and decrees discussed, current health sectorial strategy also facilitates the adaptation of telemedicine solutions in Hungary.

As for the question of telemedicine use, it can be concluded that it greatly increased between 2021 and 2024. The results indicate that while in 2021 only 28% of people used 2 or more tele-solutions, in 2024 this went up to nearly 50%. A significant increase was observed for all solutions except for sharing images with the doctor. Although the increase in teleconsultations was significant (from 6.4% to 14.2%) the use is still rather low. This suggests the need for possible incentives to encourage its use. Future research may help identify ways policy and strategy can contribute to this. The fact that in 2024 perceiving advantages of telemedicine was one of the most significant factors associated with higher telemedicine use suggest that promoting telemedicine may help increase use. By 2024 using telemedicine was not a necessity but a choice and people who perceived it positively were more likely to use it.

Besides being favourably predisposed towards telemedicine, social support is another factor associated with higher use. People living with a partner were observed to have a higher likelihood of utilising telemedicine solutions. Providing support to those who need it in using digital health solutions is also a potential path toward increasing its utilisation. Identifying ways this can be done is yet a further direction for future research.

Regarding the sociodemographic characteristics associated with telemedicine use, we can conclude that significant changes occurred between the two data collection periods. In 2021 there was a significant gender difference with women using more telemedicine. So was age, with younger people using more solutions than older ones. By 2024 these differences diminished as males and older people displayed an increase in the number of solutions used.

On the other hand, important socio-demographic differences remained in telemedicine use and it is possible to identify categories of high-users and under-users. The results suggests that higher educational levels, living in cities, being in gainful employment, having chronic illness status are constantly associated with more intensive telemedicine use. Not having a secondary school leaving exam, being in inactive labour market status, living in a village and not being chronically ill is associated with less telemedicine use.

Differences in telemedicine use by educational attainment and settlement type provide evidence of the digital paradox. People who could benefit more from telemedicine tend to use it less. Studies were discussed in the introduction section about the possibilities telemedicine may have in addressing age-old issues of health care provision. If telemedicine is to achieve its full potential, policy efforts should focus on investing in digital infrastructure and outreach in rural areas, improving digital health literacy among lower-educated groups, promoting the benefits of telemedicine through public health campaigns to change perceptions and offer social support for people who are less digitally skilled.

6.1 Strengths and limitations

The 2023 OECD report on telemedicine use during and after the pandemic stated that Hungary was one of the OECD countries that had no data on the characteristics of telemedicine users and type of telemedicine services(1). Hence the first main strength of the thesis is that it provides this data. The outcome of this thesis is never-before published results documenting changes in frequency and demographic patterns of telemedicine use in Hungary. The second main strength of the thesis was that it considered sociodemographic patterns in telemedicine use in its legal-regulatory context. It details the evolution of telemedicine related decrees, laws and strategies in Hungary during COVID-19. By looking at legislation, strategy and sociodemographic patterns in use together, future directions of telemedicine use can be identified. A third strength is the uniqueness of the study. The literature review did not yield any other population-based telemedicine studies using large scale, representative samples from during and after the pandemic. The fact that the second data collection took place in 2024, after the pandemic, shows what happened to telemedicine use in a time when the realities were no longer shaped by the lockdown and COVID-19.

An important limitation lies in the differences between the data collection methods of the two surveys. The 2021 survey used Computer Assisted Telephone Interview and in 2024 an online survey was used programmed by Ipsos Zrt. who also carried out the data collection. The survey targeted members of Ipsos' online respondent panel. This may have caused a mode effect. Differences in the mode of questionnaire administration may have led to differences in respondent compositions on the target variables between the modes. See for example Vannieuwenhuyze et al. (2013) (117). Although the number of internet users is oversampled in the 2024 sample (100% instead of the 94.1% reported in Datareportal in 2025) the bias may be negligible in our sample as stratified sampling was used and both the 2021 and 2024 samples correspond to the nearest census or microcensus.

Another limitation is that there is no information for the reason of telemedicine use and frequency of use. It is not known if they sought contact with a specialist or a GP. These limitations may act as guidance for further studies where they will be considered fully.

7. Summary

This doctoral research explored sociodemographic patterns in telemedicine use in Hungary in 2021 and 2024 within the framework of the legislative regulatory environment. To achieve this aim, it examined the evolution of telemedicine related regulation in Hungary using a narrative analysis with the approach of a systematic literature review and the quantitative analysis of two large scale, representative surveys of sociodemographic patterns in telemedicine related habits done almost 3 years apart. Our systematic literature review of original studies on surveys of general (not physician) populations and telemedicine use and attitudes during and after the pandemic revealed that the research this thesis is based on is filling an important gap. It is based on nation-wide samples stratified for gender, age, settlement type and education and it makes temporal comparison possible as the same questionnaire was administered in 2021 (N=1500) and 2024 (N=1000).

The policy analysis revealed that the pandemic acted as a catalyst for legislative activities regarding telemedicine. From a situation where non-personal health care provision was not allowed by law, quick and decisive policymaking created a legal-regulatory environment permitting telemedicine. *For a Healthy Hungary 2021-2027* the now current health sectorial strategy is the first health strategy which pays attention to telemedicine development.

The quantitative results show that the use of telemedicine tools increased markedly between 2021 and 2024. Especially notable is the spread of online appointment booking, sharing medical documents and teleconsultations. Some socio-demographic differences in telemedicine use are narrowing over time, others remain. Gender differences are diminishing, age narrowed and is no longer significant. Education and settlement type are still considerable differences, with the less educated and those people living in villages using fewer telesolutions for their health needs. This denotes the existence of the digital paradox. People living in villages have more issues accessing health care physically so they would benefit more from telemedicine. The less educated have greater health needs and experience more illness and yet still use fewer telemedicine solutions. This is an area where policy intervention is needed.

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Appendix I- The questionnaire

Population Questionnaire

Good day, my name is xxx, and I'm calling on behalf of the public opinion research company Ipsos.

In the next few minutes, we would like to ask for your help in one of Hungary's first research studies related to digital health. Your answers will help us better understand the opportunities, expectations, and limitations associated with the use of digital technologies.

All responses will be recorded completely anonymously. The data from the survey will be analyzed by researchers solely in an aggregated, statistical form.

Participation is voluntary, and completing the questionnaire takes approximately 15 minutes. Would you be willing to help me?

1.SOCIODEMOGRAPHIC DATA

D1. Which year were you born in?

D1a: Age group

1.	18–29-year-old	
2.	30–39-year-old	
3.	40–49-year-old	
4.	50–59-year-old	
5.	60-69 year old	
6.	70 year or older	

D2. What is your gender?

1.	Male	
2.	Female	
3.	Other	
99.	No answer	

D3. What is the type of your permanent residence?

1.	The capital	
2.	County seat	
3.	Town	
4.	Village	
99.	No answer	

D4. In which county do you live in?

1.	Budapest	
2.	Bács-Kiskun	
3.	Baranya	
4.	Békés	
5.	Borsod-Abaúj-Zemplén	

6.	Csongrád-Csanád	
7.	Fejér	
8.	Győr-Moson-Sopron	
9.	Hajdú-Bihar	
10.	Heves	
11.	Jász-Nagykun-Szolnok	
12.	Komárom-Esztergom	
13.	Nógrád	
14,	Pest	
15.	Somogy	
16.	Szabolcs-Szatmár-Bereg	
17.	Tolna	
18.	Vas	
19.	Veszprém	
20.	Zala	
99.	No answer	

D5. What is your highest level of education?

1.	Primary school	
2.	Vocational school (without high-school leaving diploma)	
3.	High school diploma	
4.	University/ college	
99.	No answer	

D6. What is your current family status?

1.	Single	
2.	Lives with a partner	
3.	Married-living together	
4.	Married-living apart	
5.	Divorced	
6.	Widow/widower	
99.	No answer	

D7. How many children under 18 do you have?

D8. What is your current employment status? Give the one most typical of you.

1.	Employed in managerial position	
2.	Employed with no subordinate employees	
3.	Private entrepreneur without employees	
4.	Private entrepreneur with employees	
5.	Pensioner	
6.	Unemployed	

7.	Full time student	
8.	On maternity/ paternity leave	
9.	Homemaker	
99.	No answer	

2.HEALTH STATUS

Q1. What is your health status like?

1.	Very good	
2.	Good	
3.	Satisfactory	
4.	Bad	
5.	Very bad	

Q2. do you have any long-standing illness or health problem? We consider an illness or health problem to be long-term if it has lasted for at least 6 months or is expected to last at least 6 months. Examples include high blood pressure, diabetes, cardiovascular disease, cancer, musculoskeletal disorders, asthma, and allergies.

1.	Yes	
2.	No	
99.	No answer	

Q3: If yes, what kind of health problem do you have?

Q4. Did you have test-diagnosed COVID-19?

1.	Yes	
2.	No	
99.	No answer	

Q5. Are you limited in your daily activities by any health problem or disability e.g., visual, hearing, mobility impairment, or mental health issue)?

1.	Yes, severely limited	
2.	Yes, limited but not severely	
3.	Not limited	
99.	Don't know / No answer	

Q6. In the past 12 months, how often have you used healthcare services, either in person, online, or by phone?

1.	More than once a week	
2.	Weekly	
3.	More than once a month	

4.	Monthly	
5.	More than once a year	
6.	Yearly	
7.	More seldom than yearly	
8.	Never	
99.	No answer	

3.HEALTH RELATED INTERNET USE

Q7. Do you use the internet?

1.	yes	
2.	No	

Q8. How often do you use the internet to conduct health related searches?

1.	Daily	
2.	Weekly	
3.	Monthly	
4.	More seldom	
5.	Never	

Q9. Do your friends or family help you in searching for health-related information?

1.	Yes	
2.	No	

Q10. What kind of internet sources do you search for health-related information?

1.	Webpages (fe.házipatika, webbeteg)	
2.	Blogs/Vlogs (fe.Funkcionális orvoslás)	
3.	Online rádio, Podcasts	
4.	Social media sites facebook, instagram stb. (fe, Novák Hunor, Akut szakasz)	
5.	Online communities, facebook groups, forums	
6.	YouTube or other video sharing site	
7.	Scientific publication search engines (pl. google scholar)	
8.	Medical databases (pl. PubMed)	
9.	Medical journals, medical profession sites	
10.	Other…	
99.	No answer	

Q11. How do you think doctors relate to patients searching for information online?

1.	1 – Completely against it	
2.	2	
3.	3	
4.	4	
5.	5 – Completely supportive	
99.	No answer	

4.DIGITAL HEALTH

Q12. Do you search for health-related online information even when you visit the doctor?

1.	Yes, before going to the doctor	
2.	Yes, after going to the doctor	
3.	Yes, before and after going to the doctor	
4.	No	
99.	No answer	

Q13. Which of the following have you heard of, which have you used, and which would you like to use for your health care needs?

		Q13. Have you heard of it	Q13a. If you have heard of it:		Q13b. If you haven't used it	
		1 - yes / no	1 - have already used it	2- haven't used it yet	1 – would like to us it	2 – wouldn't like to us it
1.	**<u>Online</u>** appointment booking and asking for referral					
2.	ePrescrition					
3.	Sending data on the internet (EESZT)					
4.	Social Medial (facebook, instagram) for health-related information					

5.	Apps (for example sleep monitoring)					
6.	Telemedicine: teleconsultations- Video or telephone chat with a doctor					
7.	smart devices, sensors					

Q14. Which of the following do you use, and which would you use if you had the opportunity?

Opportunity to:

1.	has already used it/ is using it
2.	doesn't use it but would use it given the opportunity
3.	doesn't and wouldn't use it

1.	Communicating with your doctor via e-mail
2.	Sharing images with your doctor digitally
3.	Carrying out a teleconsultation with your doctor (skype or video chat)
4.	Sharing health documentation with your doctor electronically
5.	Allowing your doctor to telemonitor changes in your health status
6.	Using calibrated health sensors
7.	Browsing reliable medical websites
8.	Using social media to communicate with your doctor
9.	Book a medical appointment online
10.	Having your doctor recommend apps and sensors

5. POSITIVE CONSEQUENCES OF DIGITAL SOLUTIONS

6. Q15. What do you think, what could be the positive consequences of using digital health solutions like

sensors, smart phones and apps for society?

		Yes	No
1.	Makes care more efficient		
2.	Makes care safer		
3.	Improves patient cooperation with the doctor		
4.	Comfortable		
5.	Limits the number of in person medical meetings		

6.	Saves time		
7.	Patients can get healthcare quicker		
8.	Patients are more involved in the process of care		
9.	Quality of care improves		
10.	Decreases possibility of malpractice		
11.	Improves doctor-patient communication		

6. POSSIBLE NEGATIVE CONSEQUENCES OF DIGITAL HEALTH SOLUTIONS

Q16. What do you think, what could be the positive consequences of using digital health solutions like sensors, smart phones and apps for society?

		yes	No
1.	Worse quality care		
2.	Frustrates doctors/ patients for example because of technical problems		
3.	Decreases patient satisfaction		
4.	Leads to overdiagnosis (screens out minor conditions leading to increase in case number)		
5.	Patients misunderstand information relating to their health		
6.	Faulty technology endangers recovery		
7.	Personal data are not safe		
8.	Increasing the administrative burden of doctors		
9.	Leads to burnout among doctors		
10.	Health care becomes impersonal		
11.	Other:		

7. PERSONAL ATTITUDE REGARDING DIGITAL HEALTH SOLUTIONS

Q17. How do you feel when you think of digital health solutions (smart phone apps, sensors)

1.	Very bad	
2.	bad	
3.	No special feeling	
4.	Good	
5.	Very good	

Appendix II- Evidence table

Article	Objective	Study population and time	Methodology and strength	Relevant findings and conclusions
Bajwa NM, et al. Has telemedicine come to fruition? Parents' and paediatricians' perceptions and preferences regarding telemedicine.	Evaluate parent perceptions, preferences, acceptability regarding the use of telemedicine modalities	N=222 Parents in Geneva, Switzerland in 2021	Non-probability sampling, 222 parents, survey items on sociodemographics, digital literacy, communication preferences for consultations (face to face, phone, video, email, and instant, and the acceptability of different telemedicine formats for specific clinical situations	Main benefits are avoiding transport (67%), saving time (59%), quicker access to care (44%), not missing work (37%), and avoiding ER or alternate pediatrician visits (36%). The main drawbacks: lack of physical exams (68%), some issues not suited for telemedicine (44%), possible technical problems (38%), less personal interaction with the pediatrician (27%)
Mougey EB et al. Equity and Inclusion in Paediatric Gastroenterology Telehealth: A Study of Demographic, Socioeconomic, and Digital Disparities.	Compare in-person and telemedicine paediatric care ambulatory GI at a Children's Health System based on geospatial, demographic, socioeconomic, and digital disparities	N=26,565 Paediatric patient with GI encounters at the given health facility in Delaware from January 2019 to December 2020	Strong method, Data for this study included in-person and telemedicine (but excluded telephone only) records for patient encounters conducted by NCH-DV providers	Telemedicine use rose 145-fold in 2020. Patients needing a translator were 2.2 times less likely to use it, and Hispanic or Black patients were 1.3–1.4 times less likely than White patients. Telemedicine use was higher in areas with broadband, less poverty, homeownership, and higher education
Gillenwater JA, Rep MA, Troy AB, Power ML, Vigh RS, Mackeen AD. Patient Perception of Telemedicine in Maternal-Foetal Medicine.	To analyse patient perception of telemedicine	N =347 USA Patients in Maternal–foetal medicine March 2022 to May 2022	On site survey Demographics and responses to 15 statements about telemedicine were collected via a 5-point Likert scale	71% rated telemedicine equal to in-person visits; 79% open to future use. Favourability higher among Hispanics, employed individuals, and those with prior

				telemedicine experience.
von der Groeben S et al. Telemedicine during the COVID-19 pandemic in Germany: Results from three nationally representative surveys on use, attitudes and barriers among adults affected by depression.	Investigate telemedicine use and attitudes during the pandemic among adults with diagnosed depression. Looks at clinical and demographic characteristics.	18–69-year-old German residents with professionally diagnosed depression. 3 different data collection periods: June/July 2020 with n = 1094; t2: February 2021 with n = 1038; t3: September 2021 with n = 1255	strong design, Three large scale representative online surveys. Telemedicine includes video and telephone conversations, too.	Use of video or phone consultations stayed stable. Video sessions with psychotherapists increased. People were more open to using video for discussing test results during lockdown. Most found virtual care impersonal and only as supplement, not a replacement
Dagher L et al A cardiovascular clinic patients' survey to assess challenges and opportunities of digital health adoption during the COVID-19 pandemic	To understand current and future trends telemedicine use in the cardiology clinic patient population.	N= 299 New Orleans Cardiology patient population, September 2020 and January 2021.	Strong design but can't generalise outside of the study context. Administered to all cardiology clinic patients at the Tulane University Heart and Vascular Institute.	. More common among younger, healthier, and educated individuals. Telemedicine use increased from 10.8% to 24.3% during COVID ($P < .0001$), Patients value it for easing access
Haynes SC, et al. Disparities in Telemedicine Use for Subspecialty Diabetes Care During COVID-19	To identify patient-level factors associated with adoption of telemedicine for subspecialty diabetes care during the pandemic.	N= 292 US patients who completed a visit with an endocrinologist for a diagnosis of type 1 or type 2 diabetes mellitus from March 19, 2020 through June 30, 2020	EHR data was used to compare characteristics of those who had successful video consultations with those who didnt	65+ less likely to use telemedicine (OR 0.34, 95% CI 0.220.52, $P < .001$) Non-English primary use associated with reduced use (OR 0.53, 95% CI 0.31–0.91,) Public insurance holders less likely to use (OR 0.64, 95% CI 0.49–0.84, $P = .001$
Bossa F, et al. Evaluation of factors associated with trust in telemedicine in patients with inflammatory bowel disease	Investigate trust IBD patients ave in Telemedicine	N= 376 IBD patients enrolled at two Italian tertiary referral centers 1-31 October 2021	strong design. cross-sectional observational survey.	77.9% found telemedicine valuable, but only 26.3% considered it equal to in-person care. Higher trust in telemedicine:

during COVID-19 pandemic: a multicenter cross-sectional survey.				Higher education and IT competence.
Maietti E, et al. The experience of patients with diabetes with the use of telemedicine and teleassistance services during the COVID-19 pandemic in Italy: Factors associated with perceived quality and willingness to continue.	Investigate the individual and contextual determinants of diabetes patients' willingness to continue using Telemedicine and Teleassistance diabetes using	N= 569 Italy, Patients with diabetes using TMTA services July 1 to October 31, 2020	Mobile Assisted Web Interview (MAWI) through an internal regional platform- Participants to the TMTA were invited to join	High perceived quality and willingnes to continue- Higher education linked to greater willingness to continue Feeling supported by the service and perceiving improved self-management were positive predictors of both PQ and WC
Odebunmi OO, et al. Findings from a National Survey of Older US Adults on Patient Willingness to Use Telehealth Services: Cross-Sectional Survey..	To examine respondents' (aged between 45 and 75 years) willingness to use telemedicine services (telepharmacy and telemedicine) and the correlates of the willingness to use telemedicine services.	US adults aged between 45 and 75 years in March and April 2021	Strong design cross-sectional national survey of 1045 US adults aged between 45 and 75 years in March and April 2021.	Telemedicine (64.5%) had high overall acceptance but was less favored by adults 55+. Willingness rose with convenience, low cost, or trusted providers.
Smith LC, et al Ever Use of Telehealth in Nebraska by March 2021: Cross-Sectional Analysis.	Factors associated with ever use of telemedicine in Nebraska	N= 5300 Nebraska residents (October 2020- March 2021	stratified random sample of Nebraska households. Web based survey	25.5% used telemedicine. (urban 26.4%, rural 20.8%) despite 97% internet access. Higher usage among those who are aged <45 years (32.4%), female (30.7%), and non-Hispanic (25.9%); with at least a bachelor's degree (32.6%); and with any chronic health conditions (29.6%)
Chen EM et al. and Demographic Disparities in the Use of	To identify disparities in the use of telemedicine	5,023 USA patients in ophthalmology centre from	Medical charts were abstracted for demographic information.	only 8.9% used video visits,12.8% used telephone Black and Hispanic

Telemedicine for Ophthalmic Care during the COVID-19 Pandemic.	during the coronavirus disease 2019 (COVID-19) pandemic	March 2020 through August 2020	Outcome measures: The completion of a synchronous video encounter, the completion of a telephone encounter in the absence of any video encounters, or the completion of in-person encounters only	patients had lower odds of using telemedicine (OR 0.65), and even lower odds for video visits (Black: OR 0.45; Hispanic: OR 0.56).
Sana S, et al. The role of socio-demographic and health factors during COVID-19 in remote access to GP care in low-income neighbourhoods: a cross-sectional survey of GP patients	Explores the association of sociodemographic and health factors with the decision to contact a GP practice, and care utilisation, among patients in low-income neighbourhoods in the Netherlands.	N= 213 Patients from low-income neighbourhoods, the Netherlands, June to October 2020	Small sample, Participants were stratified according to categories of these background characteristics to obtain equal numbers per category.	81% had GP contact; 56% used remote care during COVID-19. More usage: Women. Less usage: 50+ age group
Ko JS et al. Disparities in telehealth access, not willingness to use services, likely explain rural telehealth disparities	Assess whether access or willingness to use telemedicine differed between rural and non-rural and low-income and non-low-income adults	N= 5500 2 US nationally representative cohorts of rural and low-income Black/African American, Latino, and White adults. December 17, 2020-February 17, 2021	Data from the COVID-19's Unequal Racial Burden (CURB) survey, which measured the social, behavioural, and economic impact of the COVID-19 pandemic in the United States among diverse populations.	Rural (38.6% vs 44.9%) and low-income adults (42.0% vs 47.4%) were less likely to report telehealth access. no difference in willingness to use between rural and non-rural (aPR = 0.99, 95% CI = 0.92-1.08) or low-income versus non-low-income (aPR = 1.01, 95% CI = 0.91-1.13)
Zaganjor I, et al Telemedicine Use Among Adults With and Without Diagnosed Prediabetes or Diabetes, National Health Interview Survey, United	Describe the prevalence of past 12-month telemedicine use among US adults with no prediabetes or diabetes diagnosis,	US adults with no prediabetes or diabetes diagnosis, diagnosed prediabetes, and diagnosed diabetes.	2021 and 2022 NHIS data.	Telemedicine use: 52.8% (diabetes), 47.6% (prediabetes), 34.1% (no diabetes). Lower usage in nonmetropolitan areas despite

States, 2021 and 2022.	diagnosed prediabetes, and diagnosed diabetes	In 2021 and 2022		greater healthcare access challenges.
Bhatla A, et al. Patterns of Telehealth Visits After the COVID-19 Pandemic Among Individuals with or at Risk for Cardiovascular Disease in the United States.	Determine the prevalence of telemedicine visits and visit modality in people with CVD and CVD risk factors.	N= 6252 US people with CVD and CVD risk factors from 2022	Analysis from the 2022 HINT Survey	Telemedicine use was higher among individuals with CVD (50%) than those with only CVD risk factors (40%). CVD patients had twice the odds of using telehealth overall
Hung M, et al Telemedicine among Adults Living in America during the COVID-19 Pandemic.	To explore telemedicine usage across socio-demographic groups in the United States during COVID-19	US general population 4 April 2021, to 11 April 2022	Rapid online response survey that assesses household experiences during COVID-19.	Telemedicine prevalence: 47.7% (2021–2022). More common among women, obese individuals, smokers, and college-educated patients.
Zeng B. et al. The Impact of the COVID-19 Pandemic on Internet Use and the Use of Digital Health Tools: Secondary Analysis of the 2020 Health Information National Trends Survey.	Evaluate how use of digital tools to communicate with clinicians, schedule appointments, and view medical records changed near the beginning of the pandemic.	N= 3865, 1437 USA, general population Data collected between February and June 2020-	pre-post pandemic time period 2020 HINTS data	increased use of telemedicine. (adjusted OR 1.99, 95% CI 1.18–3.35). Higher-income individuals showed greater growth post-pandemic, lower educated showed less growth in using telemedicine.
Spaulding EM et al. Prevalence and Disparities in Telehealth Use Among US Adults Following the COVID-19 Pandemic: National Cross-Sectional Survey.	Evaluate the prevalence of, inequities in, and primary reasons for telemedicine visits a year after telemedicine expansion	General US population, 2022	cross-sectional data from the 2022 HINTS The primary outcomes were telemedicine visit attendance in the 12 months	38.78% reported a telehealth visit in the past year. Higher among women, insured, college graduates. The most common reasons for telehealth visits were minor illnesses, chronic disease, mental health.
Kim J et al. Telehealth Utilization and	To assess telemedicine use and its associated	N= 6252 US general population	HINT 2022	39.3% used it video (17.8%), audio (11.6%). Reason for

Associations in the United States During the Third Year of the COVID-19 Pandemic: Population-Based Survey Study in 2022.	factors in the United States in 2022 =third COVID year	March 2022 through November 2022.		nonuse: providers did not offer it (63%),preferring in-person care (84.4%)- was more likely among younger adults, women, the educated, those in poor health.
Ivanova J et al Patient Preferences for Direct-to-Consumer Telemedicine Services: Replication and Extension of a Nationwide Survey.	1) identify demographic trends in patient preferences and experiences; (2) measure ease of use and satisfaction of telemedicine; and (3) measure changes in telemedicine use, willingness, and comfort since 2017.	N= 4577 USA general population 2017 and 2022	Replicated a 2017 nationwide survey of US adults to measure patient health care access as well as knowledge, experiences, and preferences regarding telemedicine encounters	Telemedicine use increases 61.1% (2022) vs. 5.3% (2017). Primary care telemedicine use: 34.5% (2022) vs. 3.5% (2017). Overall: Increased willingness and comfort with telemedicine.
Hung CT et al. Telemedicine Use Among Adults with Asthma in the United States, 2021-2022.	Investigate sociodemographic variables and telemedicine use	USA Data from the 2021 and 2022 National Health Interview Survey were used.	2022 HINT study	47.7% used it. More common among women, obese individuals, current smokers, those with higher education, health insurance.
Murshidi R, Knowledge, Attitudes, and Perceptions of Jordanians Toward Adopting and Using Telemedicine: National Cross-sectional Study	To assess the knowledge, attitudes, and perceptions of Jordanians toward telemedicine, to identify key factors predisposing individuals to its use	N= 1201 Jordanian general population, January, 2022	Weak design, google form, self-administered questionnaire distributed through social media. Telemedicine component undefined.	51.5% were aware of telemedicine, 68% expressed a willingness to use it. Higher education levels, urban residence, and greater confidence in using electronic devices were linked to greater awareness and more favorable views
Alboraie M et al. Knowledge, Applicability, and Barriers of Telemedicine in	To evaluate knowledge, attitude, and barriers to telemedicine among the	General population in Egypt, May to July 2020	convenience sampling Complex telemedicine definition	50% used telemedicine, primarily for viewing lab results, about one-third feared privacy

Egypt: A National Survey	general population in Egypt			breaches, nearly half (13.7%) found telemedicine difficult to use, though 60.8% still preferred it over traditional care.
Tariq W et al. Impact of the COVID-19 pandemic on knowledge, perceptions, and effects of telemedicine among the general population of Pakistan: A national survey	Identify knowledge, perceptions, willingness to use, and the impact of the COVID-19 pandemic on telemedicine awareness	N= 602 General population of Pakistan, 27 May 2020 to 17 June 2020.	convenient sampling technique. online questionnaire distributed on social media	70.1% heard about it, 54.3% understood definition, 81.4% had not used telemedicine in the past. Males were more favourable.
Naik N,et al. Attitudes and perceptions of outpatients towards adoption of telemedicine in healthcare during COVID-19 pandemic	To understand the behavioural attitude and perceptions of the population regarding telemedicine before and after the pandemic	N= 1170 Outpatients in India, November 2020 to December 2020	Web based survey using Google Forms, disseminated via mailing lists and social media. Broad concept of telemedicine, including booking appointments and sharing data	39% of patients used it. Attitudes were neutral or favourable.
Aljaffary A,et al. Knowledge and attitude of Saudi Arabian citizens towards telemedicine during the COVID-19 pandemic	Investigate the knowledge and attitudes of Saudi Arabian citizens towards telemedicine during COVID-19	N= 330 General Population. Saudi Arabia, during the pandemic, exact date not given	Not representative survey distributed through social media to 1500 randomly selected citizens.	70.0% were familiar with telemedicine, 92.1% believed it could reduce transportation costs. 58.8% had not seen and 67.0% had not used telemedicine
Wang H, Liang L, Du C, and Wu Y. Implementation of Online Hospitals and Factors Influencing the Adoption of Mobile Medical Services in China: Cross-Sectional Survey Study.	Analise awareness of the Online Hospital initiative explore telemedicine services based on national conditions	N= 407 18- 59-year-old general population, western China, July 2020	convenient sampling, survey distributed by nurses to patients	only 23%of respondents were aware of online hospitals

Thomas E, et al, Patient Use, Experience, and Satisfaction With Telehealth in an Australian Population (Reimagining Health Care): Web-Based Survey Study	To understand the experience of those engaged in a telemedicine consultation during the pandemic period and the demographic factors that influence engagement	N= 1820 Australian adult general population, June 5, 2021, and September 13, 2021	A representative sample, web-based survey	69.3% had used telehealth, mostly for GP (86.1%). Older adults were more likely to seek care but less likely to use telehealth Those with higher education levels were more likely to use and report positive experiences with it.
Wong MYZ et al. Telehealth Demand Trends During the COVID-19 Pandemic in the Top 50 Most Affected Countries: Infodemiological Evaluation	To estimate the demand for telemedicine services during COVID-19, in the 50 most affected countries, comparing the demand for services with the level of ICT infrastructure	Internet searches of general population of 50 most affected countries, from January 1 to July 7, 2020	Data presented as relative search volumes from Google Trendsto extract data on worldwide and individual countries' telemedicine-related internet searches. ICT data from World Economic Forum, COVID-19 data from the WHO	An overall spike in worldwide telemedicine-related RSVs was observed from March 11, 2020, which then tailed Highest search volume was observed in Canada and the United, European countries had relatively lower search volumes

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