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

PhD thesis

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1. Introduction

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 and type of telemedicine services used. 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. Usage trend will be looked at within the framework of the legal and policy making environment since developmental patterns cannot be understood without considering this context.

1.1 Basic concepts and definitions

Telemedicine 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. 3 categories of telemedicine can be differentiated: *Telemonitoring*-. remote health data monitoring via mobile devices with real-time sharing *Store and forward* - delayed transmission of clinical data and *interactive real-time teleconsultations* - immediate and synchronous communication between providers and patients.

1.2 The role of telemedicine in health care

The significance of telemedicine goes beyond COVID-19. There is evidence that it can alleviate long standing issues in health care provision. It can lead to more equitable and efficient healthcare addressing issues like a) restricted access to health care services, b) problems caused by a scarcity of medical staff and c) issues of supervising and managing chronic conditions from home. Studies supporting this are strong. Most report positive health outcomes from telemedicine use. There is evidence

that primary care telemedicine improves access to health care. It helps self-management and empowers patients. It alleviates issues associated with medical shortages.

1.3 Systematic literature review on general population studies and telemedicine use

A systematic literature review undertaken for this thesis identified 29 relevant survey studies that focused on populational telemedicine use and attitudes. Most studies (16) were from the U.S., others were from various countries including Italy, Germany, The Netherlands, Switzerland, Australia, China, and Saudi Arabia, Pakistan, Egypt and Jordan. Studies confirm a sharp rise in telemedicine use during the early pandemic, which declined but remained higher than pre-pandemic levels. Usage and attitudes varied across different countries and populations, often reflecting underlying sociodemographic disparities. Education, age, income, race/ethnicity, and digital literacy significantly influenced telemedicine use. Women, younger, more educated, and urban residents were more frequent users. Attitudes were mostly positive.

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

Effective digital health transformation requires more than just technology—it hinges on strong government strategy, political leadership, and clear national policies. In Hungary telemedicine received minimal attention prior to the COVID-19 pandemic. Hungarian legislation was unprepared for telemedicine even though the necessary technology was available. Until March 2020, it was among nine OECD countries that mandated physical presence for medical consultations. Pre-COVID-19 telemedicine unreadiness persisted despite clear encouragement from international bodies like the WHO and the European Commission.

2. Aims

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 methodology.

2.1 The policy pillar objective

The policy pillar aims to examine the evolution of telemedicine regulation in Hungary by identifying and analysing telemedicine related regulatory and strategy documents.

2.2 Quantitative population survey pillar objective

The aims of the survey pillars are as follows: a.) compare the frequency of use of telemedicine solutions in 2021 and 2024. b.) create a composite Telemedicine Index and examine its change over the two time points, c.) investigate the role of perceived advantages and disadvantages of digital health solutions in relation to the Telemedicine Index and d.) develop a multinomial logistic regression model to identify the demographic and socio-situational factors influencing the Telemedicine Index at both time points.

3. Methods

3.1 Policy Methods

The method used is a systematic review of legislation. The National Legislation Database was searched for digital telemedicine related legislation for the period January 31, 2020 – June 30, 2024. Only legislation pertaining to digital health, telemedicine, or the functioning of EHRs was included in the analysis.

3.2 Survey pillar methods

The results of two national representative population surveys were compared. The first survey was done in October 2021, during the COVID–19 pandemic with 1,500 people over telephone. The second survey was conducted in February 2024 by interviewing 1000 people online. Both samples are representative of the Hungarian adult population by gender, age, education and settlement type. Data collection for both surveys was carried out by Ipsos Zrt. 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). The study was approved by the Medical Research Council – National Body, Hungary). The licence number is IV-10927-1/EKU.

The questionnaire used is self-developed. Telemedicine was operationalised into the following measurable variables a) email communication with a doctor, b) sharing images with a doctor, c.) sharing medical documentation with a doctor, d) online appointment booking and referral requests, e) remote consultations and f) doctor monitoring health status via smartphone. Cumulatively, these variables constituted the Telemedicine Index, the values of which ranged from 0-6.

The data analysis was carried out using the IBM Statistics statistical analysis software. 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. Pearson correlation was used to compare perceived advantages and disadvantages of telemedicine use.

4. Results

4.1 Policy results

Policymakers in Hungary used a quick succession of temporary state of emergency regulations and decrees to facilitate an increase in the number of teleconsultations. *Figure 1* illustrates the timeline of telemedicine related legislation in Hungary.

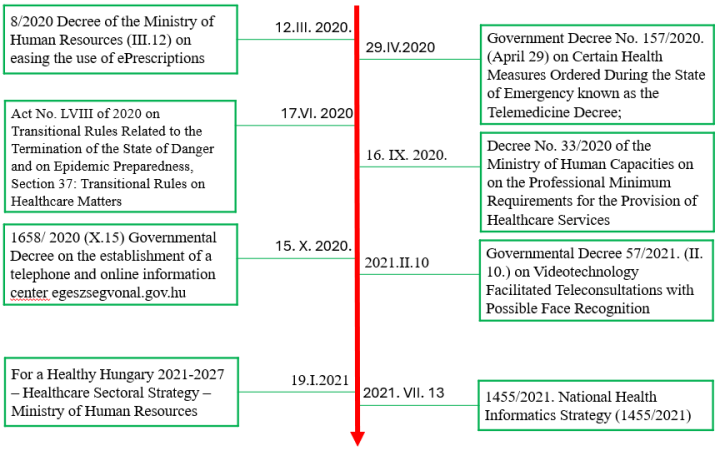

Figure 1. Digital Health Related Decrees and Legislations Passed During the Pandemic.

One key measure was the 8/2020 Decree easing ePrescription rules, allowing anyone to collect medication for others with proper identification. This enabled ePrescriptions to surge from 8,000 daily pre-pandemic to 800,000 by 2021, becoming part of routine healthcare. Hungary legalized telemedicine via Government Decree 157/2020, temporarily removing the requirement for in-person consultations if professional judgment deemed remote care adequate. It covered a wide range of interventions—from assessment, diagnosis, prescription, and follow-up to psychotherapy and physiotherapy. The 33/2020 Decree further detailed IT and security requirements, and Decree 57/2021 allowed

video-based facial ID verification. The 1658/2020 Governmental Decree created a 24/7 national health hotline and the website egeszsegvonal.gov.hu, operated by the National Centre for Public Health and Pharmacy. Although initially passed as emergency legislation, these measures were made permanent under Act LVIII of 2020, embedding telehealth into Hungary's healthcare system.

Strategically, digital health is now supported through a.) The National Digitalization Strategy (2022–2030) which focuses on digital governance and public services, b.) "For a Healthy Hungary" Strategy (2021–2027), the first sectoral plan to prioritize telemedicine and c.) The National Health Informatics Strategy (2021) which aims for integrated, AI-supported digital healthcare. According to the Global Digital Health Index (2023), Hungary ranks at Developmental Phase 4, aligned with EU averages.

4.2 Survey pillar results

4.2.1. Distributions

Table 1 shows the main frequencies of telemedicine data.

Table 1- 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	$p = 0.032$

Growth was observed across all six areas, with the most notable increase seen in teleconsultations where the proportion of users nearly doubled. Despite this growth, the overall adoption of this

form of care remains low. Telemonitoring also remained rare, used by only around 10% of patients in 2024.

The mean Telemedicine Index increased from 1.02 in 2021 (SD: 1.18) to 1.702 in 2024 (SD: 1.43) *Table 2* shows the telemedicine index frequencies by number of items used.

Table 2 Telemedicine index frequencies in 2021 and 2024
p<0,001

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

4.2.2. Multivariate analysis of variance

To continue the analysis of sociodemographic variables and telemedicine use, comparison of means using the F-statistic was utilised. Although 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 3* displays the ANOVA findings from 2021 and *Table 4* from 2024.

Table 3 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 4 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		

Between 2021 and 2024, key demographic gaps in telemedicine use in Hungary narrowed. Initially, women, younger people, the highly educated, urban residents, individuals living with partners, and parents used telemedicine significantly more. By 2024, gender and age gaps diminished, with seniors doubling their usage. Educational and settlement-based differences persisted but lessened, remaining significant. Living with a partner and being a parent continued to correlate with higher use. Chronic illness and being in gainful employment only became significant by 2024.

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

In both 2021 and 2024, respondents rated up to 11 advantages and 10 disadvantages of digital health technologies. In 2021, advantages ($M = 7.64$, $SD = 3.01$) outweighed disadvantages ($M = 5.63$, $SD = 2.72$). By 2024, advantages remained stable ($M = 7.38$, $SD = 3.49$), while disadvantages declined ($M = 4.83$, $SD = 3.18$).

The Telemedicine Index showed a weak but significant positive correlation with perceived advantages in both years, increasing from $r = .094$ ($p < .001$) in 2021 to $r = .189$ ($p < .001$) in 2024. Its negative correlation with disadvantages in 2021 ($r = –.082$, $p = .001$) was no longer significant in 2024 ($r = .007$, $p = .837$).

4.2.4 Telemedicine index and demographic factors in multivariate analysis

To analyse the constructed telemedicine index, a multinomial logistic regression was conducted using the index (recoded into three categories: 0 = no use, 1–2 = moderate use, 3+ = high use) as the dependent variable. Predictors included socio-demographic factors (gender, age, settlement type, education, employment status), family status, number of children under 18, perceived advantages/disadvantages of digital health, and

chronic illness. The model explained 17.7% of variance (Nagelkerke $R^2 = 0.177$), with "no use" as the reference category.

For moderate use (1–2) the following variables were significant:

- 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 condition increased the odds of moderate use.
- Settlement type: Compared to villages, living in Budapest increased the likelihood (OR = 1.48).
- Education: Compared to those with tertiary education, individuals without a secondary school leaving exam were less likely to use telemedicine (OR = 0.429).

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

- Age: OR = 0.968 – usage decreased with age.
- Gender: OR = 0.455 – males were less likely to be high users.
- Perceived advantages of digital health: OR = 1.104 – positively associated with high usage.
- Number of children: OR = 1.39 – more children correlated with higher use.
- Chronic illness: OR = 2.095 – strongly increased the likelihood of high use.
- Settlement type: Compared to villages:
  - Other towns: OR = 2.39
  - County seats: OR = 2.122
  - Capital city: OR = 3.062
- Education: Compared to tertiary education:
  - Secondary education: OR = 0.432
  - Primary education: OR = 0.178

A similar multinomial regression based on 2024 data (Nagelkerke $R^2 = 0.133$) revealed the following:
For moderate telemedicine use (index = 1–2), the following variables were significant:

- Living without a partner: OR = 0.559 – associated with a lower likelihood of moderate use.
- Chronic illness: OR = 1.553 – positively associated with usage.
- Education: Compared to those with tertiary 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 – identifying as male decreased the likelihood of high use.
- Perceived advantages of digital health: OR = 1.132 – positively associated.
- Living alone: OR = 0.442 – decreased the odds of high usage.
- Chronic illness: OR = 2.370 – strongly associated with increased usage.
- Settlement type: Compared to villages:
  - County seat: OR = 2.133
  - Capital city: OR = 2.379
- Education: Relative to tertiary education:
  - Primary education showed significantly lower odds (OR = 0.234).
- Labour market status: Being economically active increased the likelihood of high telemedicine use (OR = 1.583).

5. Discussion

5.1 Interpreting the results of the policy pillar

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, quick and decisive policymaking created a legal-regulatory environment permitting telemedicine. The now current health sectorial strategy is the first which pays attention to telemedicine development. There is still the need for the development of protocols to help doctors use the technology. Teleconsultations and telemonitoring need to be promoted to reap full benefit.

5.2 Interpeting the survey results

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 email communication. Gender differences and age differences in telemedicine use narrowed and are no longer significant. Education and settlement type still pose considerable differences in telemedicine use, with the less educated and rural residents using fewer telesolutions. This denotes the existence of the digital paradox. Less educated people and rural residents have greater health needs and experience more illness and yet still use fewer telemedicine solutions. This is an area where policy intervention is needed. By 2024 the role of seeing the advantages of telemedicine is significant indicating that telemedicine use is becoming a question of choice, not of necessity. Chronically ill people use significantly more telesolutions. This is a notable transformation aiding the self-management of their conditions.

5.3 Comparing digital and non-digital illness behaviour

Telemedicine use can be seen as digital illness behaviour. Like offline care, its use is influenced by factors such as gender, age, education, and place of residence. Women use offline and online health care more than men although differences greatly narrowed by 2024. Offline care increases with age, while telemedicine use was initially higher among younger people. By 2024 older adults began to catch up, reducing the digital divide. Specialist and telemedicine use rises with education level. While primary care access is consistent across regions, specialist and telemedicine use are higher in urban areas. This reflects disparities in service availability and digital literacy, which is lowest in rural areas. These findings highlight the persistent inequalities in digital health access and the existence of the digital paradox. Improving digital literacy among older adults, the less educated, and rural residents, is a goal of Hungary's National Digitalisation Strategy 2022–2027.

6. Conclusions

This thesis examined telemedicine use in Hungary in 2021 and 2024 through policy and survey analysis. COVID-19 accelerated regulatory development, resulting in a solid legal framework. Telemedicine use nearly doubled, yet teleconsultation and telemonitoring remain low, signaling the need for further policy action. There is evidence for telemedicine's potential to address long-standing health care challenges. To fully realize this potential, policy should invest in digital infrastructure, improve digital literacy—especially among less-educated groups—and promote telemedicine through public campaigns and support for digitally vulnerable populations.

9. Publications included in the research

1. Boros J, Girasek E, Döbrössy B, Győrffy Z. Use of digital healthcare among people living with disabilities. Disabil Stud Spec Educ. 2022;2022(2).

2. Döbrössy B, Girasek E, Győrffy Z. The adaptation of digital health solutions during the COVID-19 pandemic in Hungary: a scoping review. Int J Health Policy Manag. 2024;13:7940. IF:5.1

3. Döbrössy B, Girasek E, Susánszky A, Koncz Z, Győrffy Z, Bognár VK. "Clicks, likes, shares and comments": a systematic review of breast cancer screening discourse in social media. PLoS One. 2020;15(4):e0231422. IF: 3.240

4. Girasek E, Boros J, Döbrössy B, Győrffy Z. E-physicians in Hungary: Experiences and opinions related to digital health among Hungarian physicians. (E-orvosok Magyarországon: Digitális egészséggel kapcsolatos tapasztalatok és vélemények a hazai orvosok körében) Orv Hetil. 2023;164(4):132–9. IF:0.8

5. Girasek E, Boros J, Döbrössy B, Susánszky A, Győrffy Z. E-patients in Hungary: Knowledge and habits related to digital health based on a national representative survey (E-páciensek Magyarországon: Digitális egészséggel kapcsolatos ismeretek, szokások egy országos reprezentatív felmérés tükrében). Orv Hetil. 2022;163(29):1159–65. IF:0.6

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9. Győrffy Z, Döbrössy B, Boros J, Girasek E. Unveiling the digital future: perspectives of Hungarian physicians under 35 years old on eHealth solutions. Frontiers in Digital Health. 2025 Jan 27;6:1464642. IF: 3.8