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E-patients and E-physicians in Hungary

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Impressum

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Introduction

"The future of health is digital," said WHO director-general Tedros Adhanom Ghebreyesus and Doreen Bogdan Martin, ITU secretary-general, in a joint statement, "We must work together to promote universal access to these innovations and prevent them from becoming another driver of inequality."

The COVID-19 pandemic has shown the potential of digital solutions in healthcare. Telemedicine, apps, chatbots, vaccine delivery drones, or even the search for valid health information became a reality almost instantly.

It was at this moment in 2020 - the first year of the pandemic - that our team started its four-year research. Our research plans were defined by the pandemic from the very first moment, both in terms of data collection and the fields to be investigated. The publication of the ChatGPT in November 2022 was also a pivotal moment, as it opened up the possibility of its use in healthcare. All these "external conditions" have basically determined the focus of our research.

During and after the COVID-19 pandemic, in 2021 and 2024, we surveyed patients which highlighted the strong interest of the population in digital health solutions. The first results of our 2024 survey show that among internet users (representing almost 89% of the population!), 90% search for health and disease information more or less frequently, mainly through websites. Our data also demonstrates that there is an overwhelmingly high level of internet use at the time of personal doctor's appointments: nearly three-quarters of respondents search for relevant information both before and after their meeting with the health care provider. It is also worth mentioning that one in two patients would like to email their doctor, one in two use various smart devices and a significant number are interested in various apps and sensors. These results show that around 30% of patients are explicitly receptive to AI-based solutions, to their doctor using such solutions for diagnostics, decision-making or mental health management, or even risk assessment.

At the same time, an important research question is how access to these opportunities varies between different social and demographic groups. Several of our studies have focused on the 'digital health paradox', and many of our analyses have sought to explore digital inclusion, particularly for vulnerable groups

(over 65s, people living with disabilities, and people experiencing homelessness), as the use of digital health solutions can be particularly important in increasing access to healthcare for these groups. We have found that peer and community support is key to creating 'technological equity' and trust is also a key factor. Our telemedicine pilot project with the Hungarian Charity Service of the Order of Malta was the first attempt in Hungary to test the feasibility of telemedicine services among people who live with homelessness.

Our research has also shown that digital transformation in healthcare is not a simple matter of technological change. It requires adaptive changes in human attitudes and skills, too. Digital health solutions make new approaches of care possible by moving diagnosis, treatment, and prevention out of the clinics and into the everyday settings of people's lives.

The digital revolution is a revolution in healthcare and a revolution in the role of the patient and the physician. Digital health could enable individuals to "take control of their own health and well-being" and it has a very important role in patient empowerment. Patient-centricity is slowly being replaced by patient-centered design, a new era where healthcare is designed not "with the patient in mind" but with patients as team members. We must conclude that the traditional era of the doctor-patient relationship is over, digitalization and patient-based solutions mean inevitable changes in this process.

In this book, we present the main results of four years of research from both the provider side physician and medical student) and the patient side. We hope that our research can provide important input for the design and implementation of digital health solutions, as we need to know where we stand to start the journey. We write to act as a 'compass', in the hope that our work can help patients, providers, and the whole health system.

Bence Döbrössy, Edmond Girasek,
Zsuzsa Győrffy

Facilitating the Adaptation of Digital Solutions in Hungary: the Policy Background

Key Messages

- The use of digital solutions is not only a technical issue; whether doctors are inclined to use it also depends on the legislative and financing background.
- The WHO states that governmental programs, policies, and regulations are the prerequisites for the digital transformation of healthcare.
- The technology was already in place to make the digital switch before the pandemic but the fragmented regulatory system and a lack of a clear legislative framework made its adaptation difficult.
- During the pandemic, the advantages of digital health became more apparent. The need for tele-solutions was overwhelming.
- Between 31 January 2020 and 1 June 2022, 7 major pieces of legislation were passed creating an environment where digital solutions could be adapted.
- *The National Health Informatics Strategy* adopted in July 2021 provides the framework for digital health in the post-COVID-19 era.
- The sectoral healthcare strategy entitled *For a Healthy Hungary 2021-2027* published by the Ministry of Human Resources in January 2021 is the first sectorial policy that deals with digital issues.

Introduction

International experience shows that success in digitizing healthcare is built on effective strategy, strong political will, a well-articulated national mandate, and dedicated agencies. As the WHO concludes in their global study of digital health development of member countries, relevant governmental programs, policies, and regulations are the prerequisites for the implementation of digital health (WHO, 2020). Hence if we aim to understand how digital health is taking root and developing in Hungary, first we need to look at how the legislative background and health and IT sectoral strategies are helping or hindering this.

Before 2021, Hungary did not have an advanced digital health strategy. Although telehealth initiatives were present and there were sporadic plans and ideas for its development, there was no accepted governmental strategy dealing with it. Digital health was neither addressed in healthcare strategies nor in digitalisation strategies (Döbrössy et al, 2024). The legal background was also undeveloped and fragmented. There was no clear regulatory system. Doctors who may have liked to use digital solutions would have had to interpret what was allowed and what was not from multiple sources. No wonder not many practitioners adopted digital health technologies in their practices. Without clear strategies and guidelines, telehealth pioneers had a hard time initiating their field and mode of operation. Issues of reimbursement, privacy, minimum requirements for the use of telemedicine, quality assurance, etc. were unregulated.

During the pandemic, we had a situation where face-to-face encounters had to be limited. Tele-solutions became the norm in education, business, and to a lesser extent in healthcare as well. A rapid succession of legislation was needed to facilitate its adaptation in healthcare, too.

A clear legal framework is vital for medical practitioners to feel safe and confident in using digital health solutions. Health care practitioners want to be reimbursed for their online activities. They need protocols and guidelines helping them in this new activity. One role of digital health-related legislation was to provide such a 'user-friendly' environment.

Methodology

The core research method of this chapter is a review of legislation using the principles and methods of a systematic literature review. The National Legislation Database was searched for digital health-related legislation for the period between 31 January 2020 and 1 June 2022. The dates used correspond with the foundation of the Governmental Operative Board set up to coordinate the Hungarian COVID-19 response and the termination of the State of Emergency rule. The search terms we used were "digital health" (digitális egészség) "telemedicine" (telemedicina), "Teleconsultations" (távorvoslás) and "Electronic Health Records" (EESZT).

In order to be included in the analysis, the legislation had to have relevance beyond COVID-19. Seven relevant legislations were identified:

- *Government Decree No. 157/2020. (April 29) on Certain Health Measures Ordered During the State of Emergency known as the Telemedicine Decree;*
- *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;*
- *Decree No. 33/2020 (September 16) of the Ministry of Human Capacities on the Amendment of Decree 60/2003 (October 20) 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 (February 28) of the National Institute of Pharmacy and Nutrition on the Settlement of Performance;*
- *EU Digital Vaccination 366/2021. (VI. 30.) Governmental Decree;*
- *Governmental Decree 57/2021. (II. 10.) on Videotechnology Facilitated Teleconsultations with Possible Face Recognition;*
- *8/2020 Decree of the Ministry of Human Resources (III.12) on easing the use of ePrescriptions; and*
- 1658/ 2020 (X.15) Governmental Decree on the establishment of a telephone and online information center.

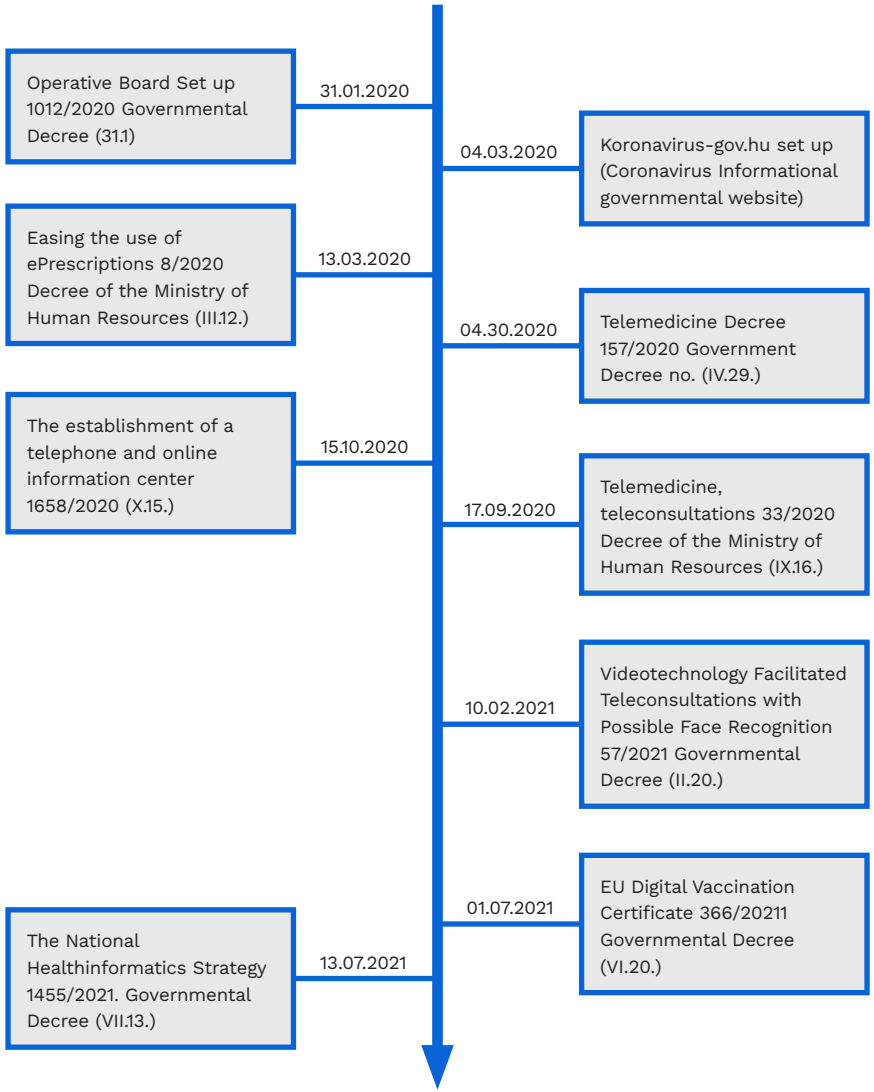

Figure 1: Timeline of the major digital health related decrees and legislations during the pandemic. (Döbrössy et al, 2024)

To provide context for the analysis, other relevant documents were identified through desk research. Three major strategy documents have great significance for the future of digital health development in Hungary:

- a healthcare sectoral strategy document entitled *For a Healthy Hungary 2021-2027* - Healthcare Sectoral Strategy published by the Ministry of Human Resources in 2021;
- the National Health Informatics Strategy entitled *Nemzeti Egészséginformatikai Stratégia* in Hungarian, accepted in July, 2021; and
- the National Digitalisation Strategy (NDS) 2022-2030 entitled *Nemzeti Digitalizációs Stratégia* in Hungarian.

These are described in depth in the present chapter as they indicate the direction digitalisation is likely to take in Hungary.

Results

In what follows, we will first briefly describe EHR use and development in Hungary before and during the pandemic period. Then we will see how decrees and regulations made telehealth solutions more applicable. Finally, we will see shifts in eHealth use. We will finish by looking at Health Informatics and Digitalisation governmental strategies as well as health sectorial strategies to briefly discuss digital health development in the years to come.

Electronic Health Record (EHR)

The EHR is a cloud-based unified communication platform for both healthcare providers and patients. The operation of the EHR was set in law by the Ministry of Human Resources decree 39/2016 (XII. 21.). Its use has been mandatory for publicly financed healthcare providers and pharmacies since 1 January 2017, for ambulance stations since 1 November 2018 and for private healthcare providers since 1 January 2020. Before gaining access, healthcare providers as well as pharmacies are required to take a training course and sit an exam.

Annually, about 75 million medical documents and close to 180 million doctor-patient appointments are recorded in it (Varga el al, 2022). There was significant growth during the pandemic period. ePrescription rates increased from 8000 per day before the pandemic to 800 thousand by 2021. Additionally, the number of procedures initiated by doctors on the system rose from 8.6 million in 2018 to 30 million in 2020. The increase was not only in volume of use. Over 20 new features were introduced.

Data entry is organized into three modules: the Central Event Catalogue (encompassing various types of specialized care), Medical Documents (meaning medical reports and test results), and the medical profile (overview of the patient's general health condition).

The key functions of the EHR are the following::

- **eProfile:** A comprehensive record detailing the individual's health status and relevant characteristics for future treatment.

- **ePrescription:** This module streamlines the prescription process. Physicians can review patients' prescription history, while certified pharmacists can access dispensing history and screen for potential interactions (subject to consent rules).

- **eReferral:** Facilitating communication between referring physicians and those performing examinations, this module ensures the reliable transfer of all pertinent information via IT systems.

Telehealth

As documented in the chapter on E-patients in Hungary: Digital health Experiences and Attitudes among Patients, the respondents in our population survey manifested considerable interest in teleconsultations and other tele-solutions. The chapter on Digital Health and People Experiencing Homelessness in Hungary provides evidence that the interest is just as high among people experiencing homelessness.

On 12 March 2020, one day before the decision to close down schools, the *8/2020 Decree of the Ministry of Human Resources (III.12) on easing the use of ePrescriptions* was passed to allow proxies, for example, relatives, to pick up Prescriptions. Indeed, according to our own survey close to 93% of our respondents used ePrescriptions and over 92% heard of them by 2021 (Girasek et al, 2022).

Telemedicine use in Hungary is governed by a law created for the state of emergency during the COVID-19 epidemic. State of emergency rules governing teleconsultations came into force on 30 April 2020 when the government issued *Government Decree no. 157/2020 (IV. 29.)* known as the *Telemedicine Decree*. This decree obliged healthcare facilities to be equipped to provide teleconsultations. They had to have a protocol and patient information material on it. The decree defined the criteria of teleconsultations as well as the aims it must serve. It permitted telemedicine use to diagnose, suggest therapy, consult, manage and direct patients, give referrals, and prescribe medication. Issues of reimbursement were also addressed naming specifically the tele-interventions for which healthcare providers may be remunerated for. This is a very important issue for providers as getting reimbursed for services is essential for the effective operation of any system.

The next relevant decree passed was the *33/2020 Decree of the Ministry of Human Resources (IX.16) on Telemedicine and Teleconsultations*. This is a ministerial decree reinforcing the previously mentioned governmental decree. It discusses the preconditions under which providers may offer teleconsultations. They must have the IT equipment needed for the service provision, medical equipment needed for the provision, detailed telemedicine use guidelines and patient information sheets, broadband, stable internet, and protections against cyber threats. The decree also established what telemedicine interventions could be reimbursed.

A governmental decree dealing mostly with the security issues of teleconsultations is *Government Decree 57/2021. (II. 10.) on Videotechnology Facilitated Teleconsultations with Possible Face Recognition*. This allows providers to diagnose, prescribe, and propose therapies as a result of teleconsultations using video technology where facial identification is feasible. Facial recognition is needed only if no other method is possible due to the nature of diagnoses or data protection. Sufficient identification documents must be shown during the consultation.

Together these decrees created a sufficient framework in which teleconsultations may be provided. They define what equipment is needed, what interventions may be performed remotely, how doctors are to be reimbursed for tele-services, and what kind of identification is needed.

eHealth

THe WHO defines **eHealth** as the cost-effective and secure use of information and communications technologies in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research. This is another vitally important aspect of digital health solutions. Patients' information needs are great and this was even more so during COVID-19 when we were faced with an unknown danger. Even before the pandemic, very many people used the internet to search for health-related information. (Döbrössy et al, 2020) Fake health-related news, unreliable sources of online information, and many people's lack of ability to distinguish between reliable and unreliable sources justified the government to oversee this field. Safe, easy-to-understand, regulated, and readily available sources are needed not only to empower people to make thorough health-related choices but also to lessen the burden on already overworked doctors. This was the reasoning behind *Governmental Decree 1658/2020. (X. 15.) on The National Healthcare Telephone Customer Service and Online Information Center*. The centre is operated by the National Public Health Centre. This initiative goes beyond COVID-19. It contains all sorts of health- and illness-related information.

There is a free telephone information service answered 7 days a week, 24 hours a day by trained non-medical dispatchers. They can inform callers on COVID-19-related issues, health services and facilities, the use and functions of the EHRs, ePrescriptions, screening services, prevention, and health promotion. This is very useful for people who are not so digitally literate and prefer talking to people and asking questions directly. E-mail inquiries are also answered. There is also an easy-to-use web page containing information on healthy lifestyle, screening tests, vaccinations, and health promotion. It lists health facilities by type and location. There is also an A-Z of symptoms and illnesses written in a clear, easy-to-understand form.

Although the system is good at meeting the needs of users even with low health literacy, it is not very well-known by the general population so it does less good than it potentially could.

Digital Health Strategy in Hungary - Future Trends

The overall framework of digitalisation in Hungary is the *National Digitalisation Strategy* (NDS) 2022-2030. Its pillars are digital infrastructure, digital skills, digital economy, and digital state. Digitalisation of public administration is a priority involving (1) synchronised, user-centred digital development of administrative and professional systems; (2) launching a data-driven administration (3) developing smart settlements and smart areas; (4) improving security of government electronic services; and (5) digitalising public services in healthcare, transport, energy, education, and culture.

Specific to digital health is *For a Healthy Hungary 2021-2027- Healthcare Sectoral Strategy- (Ministry of Human Resources, 2021, January)*, where for the first time ever digital health is featured as an aspect of health-sector strategy.

This eHealth action plan is structured around 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. This general health sector strategy laid the groundwork for *The National Health Informatics Strategy* accepted by Governmental Decree 1455/2021. (VII. 13.). The government states that the strategy aims to improve health care and public health via informatics, digitalisation, and AI. The three basic principles of the strategy are people-centeredness, digital transformation, and integrated care. The focus is on healthcare system management, disease prevention, and health promotion. The specific areas discussed are the development of eHealth awareness (eHealth functions for the population, education, prevention), digitalising processes of care, health system management, telemedicine, and Big Data.

Conclusions: Where Does Hungary Stand in International Comparison?

Placing Hungary's digital health readiness into international comparison is not an easy task. First, any ranking from before 2020 is meaningless as COVID-19 radically rewrote digital health development. For example, the WHO Digital Health Atlas hasn't been updated since 2018. The WHO publication *The Ongoing Journey to Commitment and Transformation of Digital Health in the WHO European Region 2023* (WHO, 2023) is very thorough but does not have a country-level breakdown of data, only regional. Second, although there are some methodologically very thorough indexes, Hungary is only in a few of them. One such tool is the Global Digital Health Index. (GDHM, 2023)

The GDHI monitors the country-level digital health environment globally. Data is collected through an online survey, together with the ministry of health or country digital health agency. This tool is based on the WHO International Telecommunication Union National eHealth Strategy Toolkit. It was last updated in May, 2023, so the data is post-pandemic.

The GDHI ranks countries based on the dimensions of leadership and governance, strategy and investment, legislation, strategy and compliance, workforce, standards and interoperability, infrastructure, services, and applications. These indicators have a lot of sub-indicators. Unfortunately, the data for Hungary is rather incomplete. Data is only available for Leadership and Governance, Legislation, Policy, and Compliance It means data on other dimensions was not available to the ministry. Scoring is done through developmental phases from 1 to 5, where 5 means the most developed phase. Hungary is in overall developmental phase 4. This is the average for the European Region.

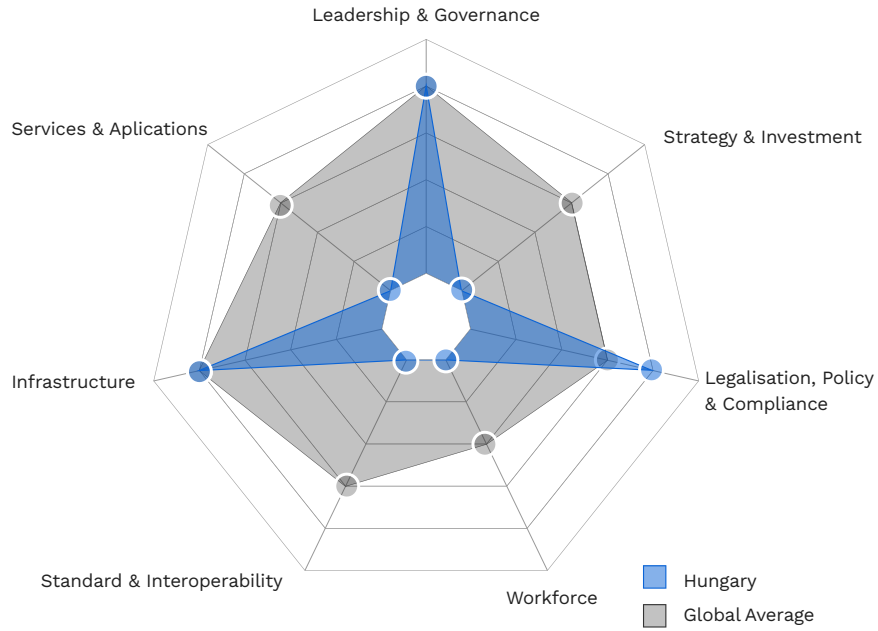

Figure 2: GDHI phase overview of Hungary, as compared to the global average in 2023. The Global digital Health Monitor, Source: https://monitor.digitalhealthmonitor.org/country_profile/HUN (GDHM, 2023)

In the dimension of leadership and governance Hungary is in Phase 4. This is the global average. For the sub-indicator of the legal framework for data protection we are in Phase 5. Here, Hungary outperforms the global average, which is 4. For the sub-indicator of laws or regulations for privacy, consent, confidentiality, and access to health information (privacy) we are in Phase 3 (but here, this is the global average). For the dimension of Infrastructure, Hungary is in Phase 4 overall. Network readiness is 3, which is under the global average of 4. On the other hand, planning and support for ongoing digital health infrastructure maintenance is in phase 5 aligned with the global average being 4. For digital health infrastructure we are at the global average of 4.

Finally, let us provide a brief summary of the 2022 WHO digital health survey conducted in its 53 member states so that we can place the Hungarian development in perspective (WHO, 2023).

A total of 83% of responding states have a national digital health policy or strategy. As we have seen, Hungary is among them. 98% have seen improvements in accessibility, quality, safety, and efficiency. There is evidence discussed above that this is so in Hungary, too. 77% of responding countries have established a national agency to oversee the adoption and use of digital health technologies. Hungary has such an agency, too, the National Health-Informatics Board. 52% developed policies and strategies for digital health literacy and 56% have a digital inclusion plan. Digital inclusion features in the National Digitalisation Strategy (NDS) 2022-2030. 87%, among them Hungary, has a national EHR system. Telehealth is addressed in the policies or strategies of 78% of member states and 77% utilize telemedicine or remote patient monitoring. We saw that Hungary is among them, too. Also, Hungary is among the 59% of member states who introduced new laws or policies to support telehealth.

To conclude, digital health can only reach its full potential if both doctors and patients are willing to adopt it. This is only feasible in a legally regulated environment in which health care providers feel safe to use the new technology and are guided by protocols. The COVID-19 pandemic compelled healthcare providers and patients to use digital solutions, prompting policymakers to swiftly establish the financial and legal frameworks needed for this transition during the crisis. The current challenge is to establish conditions that support the ongoing integration of digital health in the post-COVID-19 era.

The chapter is based on the following article:

Döbrössy, B., Girasek, E., & Győrffy, Z. (2024). The Adaptation of Digital Health Solutions During the COVID-19 Pandemic in Hungary: A Scoping Review. *International Journal of Health Policy and Management*

References

World Health Organization (2020) Draft global strategy on digital health 2020–2025, Geneva: World Health Organization

Döbrössy, B., Girasek, E., & Győrffy, Z. (2024). The Adaptation of Digital Health Solutions During the COVID-19 Pandemic in Hungary: A Scoping Review. *International Journal of Health Policy and Management*

Varga, E. S., J; Halkóné. K; Jókai, M. . (2022). The impact of the COVID-19 epidemic on the development and spread of healthcare eServices [In Hungarian].

Girasek, E., Boros, J., Döbrössy, B., Susánszky, A., & Győrffy, Z. (2022). E-patients in Hungary: Digital health use and attitudes based on a representative nationwide survey. *Orvosi hetilap*, 163(29), 1159-1165.

Döbrössy, B., Girasek, E., Susánszky, A., Koncz, Z., Győrffy, Z., & Bognár, V. K. (2020). " Clicks, likes, shares and comments" a systematic review of breast cancer screening discourse in social media. *PLoS One, 15*(4), e0231422.

WHO (2023). The ongoing journey to commitment and transformation Digital health in the WHO European Region. https://www.who.int/europe/publications/i/item/9789289060226

GDHM (2023). The State of Digital Health Report 2023, https://static1.squarespace.com/static/5ace2d0c5cfd792078a05e5f/t/656f97969301e337ada15270/1701812128734/State+of+Digital+Health_2023.pdf

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Methodology

In order to explore digital health issues from multiple perspectives, the research used multiple methodological approaches: the research of the D.E.M.O. project consisted of several quantitative and qualitative surveys, observation and secondary and social media analysis. These are the following:

- 2 representative, nationwide population surveys (in 2021 n=1500 and in 2024 n=1100),
- A nationwide representative physician survey (n=1750) in 2021-2022,
- 3 questionnaire surveys with the Hungarian Charity Service of the Order of Malta (n1=98, n2=662, n3=55),
- Online medical student survey (n=530).
- Additionally, 62 semi-structured physician interviews were conducted in 2021-2022, and in 2023, we conducted 12 interviews with homeless people.
- During the social media analysis 200 Facebook conversation threads were analysed using text-based discourse analysis.

The whole research was approved by Hungarian National Scientific Ethics Committee (TUKEB) under TUKEB number IV-10927-1.

Physician Survey

In the framework of the “E-doctors and E-patients in Hungary” research, we conducted an online survey among doctors working in Hungary. The survey questionnaire was available online in a self-completion format between July 2021 and May 2022. The questionnaire was developed in-house by the research team, and it was important to ensure that the results were comparable with our population survey. Respondents were contacted via a newsletter sent by the Hungarian Medical Chamber (HMC) and a personalised e-mail invitation letter. Conducting the survey was significantly complicated by the 3rd and 4th waves of the COVID epidemic, which affected all doctors working in patient care. Accordingly, the survey was implemented in several waves, with a newsletter to the HMC members in autumn 2021 and a targeted email survey to physicians in agreement with the HMC in spring 2022, after the COVID epidemic had subsided. The total number of questionnaires received was 1774, of which 1576 were general

practitioners and 198 dentists. For methodological reasons, the data for general practitioners and dentists were analysed separately.

Correction weighting was applied to the responses received, based on the Operational Register statistics received from the Directorate of Human Resources Development - National Directorate Genaral for Hospitals, by gender, age and county of workplace. Correction weighting was necessary due to the slight variation in the sample compared to the main distributions of the Operating Register, with a mean value of 1 for the weight variable, 0.6255 for the first quartile and 1.1942 for the third quartile.

In the COVID-19 epidemic, digital tools became an integral part of care overnight, and in certain phases of the epidemic, in certain areas (primary care), they were only available online. On the one hand, this means that the respondents were able to express their opinions authentically, based on their everyday experience, but on the other hand, the crisis situation and the inevitability of the transition also posed great difficulties for the doctors interviewed. This duality is important to take into account when interpreting the responses.

The statistical methods used for each analysis are presented in the relevant chapter.

The nationwide survey “E-doctors and E-patients in Hungary” was conducted by the Digital Health Working Group of the Institute of Behavioural Sciences of Semmelweis University under the framework of the OTKA -FK 134372 research programme.

Survey among Dentists

An online survey was conducted as part of the “E-doctors and E-patients in Hungary” research among Hungarian dentists . The dentistry-focused part of the survey consisted of five main sections (sociodemographic, dental work, digital technologies, and digital healthcare-related concerns) and 84 questions. Eight dentists from the Department of Community Dentistry at Semmelweis University in Budapest, representing different fields and age groups (23-40), participated in the pretesting procedure. With the assistance of the Hungarian Medical Chamber, respondents were reached through personal email invitations and newsletters. The population comprised of Hungarian dentists who provided a valid email address to the chamber.

Participants accessed the questionnaire via a provided URL. To address nonresponse, the survey was resent to participants. After closing the survey, we checked for duplicate responses but found none. The Evasys survey system, which does not retain IP addresses, was employed to ensure compliance with GDPR requirements, thus protecting respondents’ anonymity.

A four-dimensional corrective weighting procedure was executed by gender, age, city (Budapest or not), and specialization (specialized or not). After weighing these four dimensions, the data in these variables estimates the Hungarian dentists.

SPSS software was used for statistical analysis. To avoid missing data, every outcome is listed with the number of received answers (valid percent). Descriptive statistics, including frequencies, medians (M), means, and crosstabs, were used to present demographic data. A p-value below 0.05 was considered significant.

A digital dental index (DDI) variable was created as a summary of various factors related to the use and knowledge of digital technologies in dentistry. A linear regression model was built using the DDI as a dependent variable, with advantages, disadvantages, necessary factors, experienced needs from patients, and age as explanatory variables. The index ranges between 0 and 27.

Population Surveys

Population Survey in 2021

Within the framework of the research programme “E-doctors and e-patients in Hungary: the role and opportunities of digitalisation in health care” - OTKA-FK 134372, funded by the National Research Centre for Health Research and Innovation (NKFIH), a national representative questionnaire survey was conducted by telephone (CATI), interviewing 1723 respondents. The sample was selected using a stratified sampling procedure in terms of gender, age, type of municipality and educational attainment and is representative of the adult population of Hungary. Data collection was carried out by Ipsos Zrt. between 5 and 13 October 2021.

The sampling frame was 12,000 persons, randomly selected from an open telephone enquiries database, and 8,000 persons were selected as a reserve sample. 11,733

respondents refused to complete the survey and 1,293 dropped out, but most of this was due to the sampling quota. The coverage was 80% mobile and 20% landline.

Correction weighting was applied to the data to improve representativeness. The analysis was carried out with a correction weighting of 1500 persons, so the number of items used in the analysis is 1500.

The main blocks of the 25-question, 15-minute, self-developed questionnaire were: sociodemographic data, health status trends, frequency of internet use for health purposes and nature of searches, knowledge and use of digital health technologies, positive and negative attitudes towards the use of digital health solutions. Our questionnaire is available at the link here.

Data were analysed using IBM Statistics (SPSS 27) statistical data analysis software. Statistical data processing included distributions, cross-tabulation analyses and chi-square tests.

Population Survey in 2024

The study was conducted using a structured 15-minute online questionnaire developed by the Digital Health Working Group of the Institute of Behavioural Sciences of Semmelweis University and administered to a sample of Ipsos online panel members. A total of 1,100 respondents aged 18 and older from the domestic population participated. The primary analysis was based on a representative quota sample of 1,000 participants, selected to mirror the domestic adult population according to gender, age, municipality type, region, and educational attainment. These demographic variables, drawn from panel profiling data, guided the targeting of the questionnaire distribution.

To ensure robust representation of older adults within the sample, an additional 100 respondents aged 65 and older, termed the “senior boost,” were included in the study. Data collection took place over a 10-day period, from February 12 to February 22, 2024.

Methods for the Research in Collaboration with the Hungarian Charity Service of the Order of Malta

As a common ground for the studies, we used the definition for homelessness to include all individuals who had engaged with institutions providing homeless services according to the categories of the European Typology of Homelessness and Housing Exclusion, the standard used by European Union member states for reporting on homelessness and precarious housing circumstances.

1) Exploratory attitude survey of homeless persons regarding telecare services

Between April 14-21, 2020, the Digital Health Working Group, with the help of the Hungarian Charity Service of the Order of Malta, used a self-developed questionnaire in 4 Budapest homeless shelters involving 98 people to assess their attitudes related to digital health technology, especially telemedicine. As a control group, 110 patients from two, medium sized Budapest general practices were used.

3 of the shelters are operated by the Hungarian Charity Service of the Order of Malta (Budapest, Hungary) and one shelter is operated by a partner institution (Shelter House Foundation, Budapest, Hungary). The selection of the participating homeless shelters in the study was based on one main criterion: the admission of clients to these establishments is determined by the applicant’s health care needs. According to the European Typology of Homelessness and housing exclusion (ETHOS) classification, three of the shelters are categorized as 7.2 (supported accommodation), one shelter is categorized as 7.1 (residential care for homeless people).

Health care and telecare-related opinions and attitudes were measured by using a questionnaire developed by the research team that you can access here.

As part of the quantitative analysis, we descriptively examined frequencies, averages, and percentage distributions. Telecare and its various correlates (demographic variables, variables related to access to health services) were compared with single variable analysis using Pearson's Chi-squared test ($\chi 2$), with a significance level of $p<0.05$. When comparing averages, we used the ANOVA model and F-test, with a $p < 0.05$ significance level. In our multivariate analysis, a binary logistics regression model was executed among the homeless sample. Logistic regression analysis was used to look at the background factors of the statement of *I definitely prefer in-person doctor-patient consultations*.

2) Telemedicine in Community Shelters: a Pilot Project

Based on the results of an attitude survey among homeless people in the first half of 2021, the telemedicine pilot project was designed and carried out by the Digital Health Working Group and the Hungarian Charity Service of the Order of Malta.

A total number of 75 adult participants were recruited from four shelters providing mid- and long-term accommodation (with a limit of usually one year that might be extended for one more year) to people experiencing homelessness in Budapest, Hungary.

Participation was voluntary and only one inclusion criterion was applied: the client had to have at least one pre-existing chronic condition that required regular medical follow-up. Although we did not exclude any disease groups, recruitment was focused on clients with cardiovascular, pulmonary, and metabolic diseases.

Recruitment went on for four weeks before the telecare visits started (between February 8 and March 7, 2021). Prior to the first telecare visit, a short medical folder of patient history was filled in by each participant and was available for the physicians. Each participant of the pilot was invited to six online telecare visits biweekly (every two weeks) with a focus on medical management of chronic conditions. The visits took place on an appointment basis and keeping appointments were facilitated by the on-site assistants. Anonymized accounts of popular video call services were used by the care teams. Telemedical health care was provided by three physicians of the Health Center of the Hungarian Charity Service of the Order of Malta (Budapest, Hungary) consisting of two internal medicine specialists and a primary care physician. The visits took place between March 10 and July 30, 2021.

After completion of the pilot, closing focus group discussions were organized for both physicians and on-site assistants to summarize their experiences. A follow-up survey among available previous clients in all four shelters was completed after four to six months of pilot closure, between November 9 and December 7.

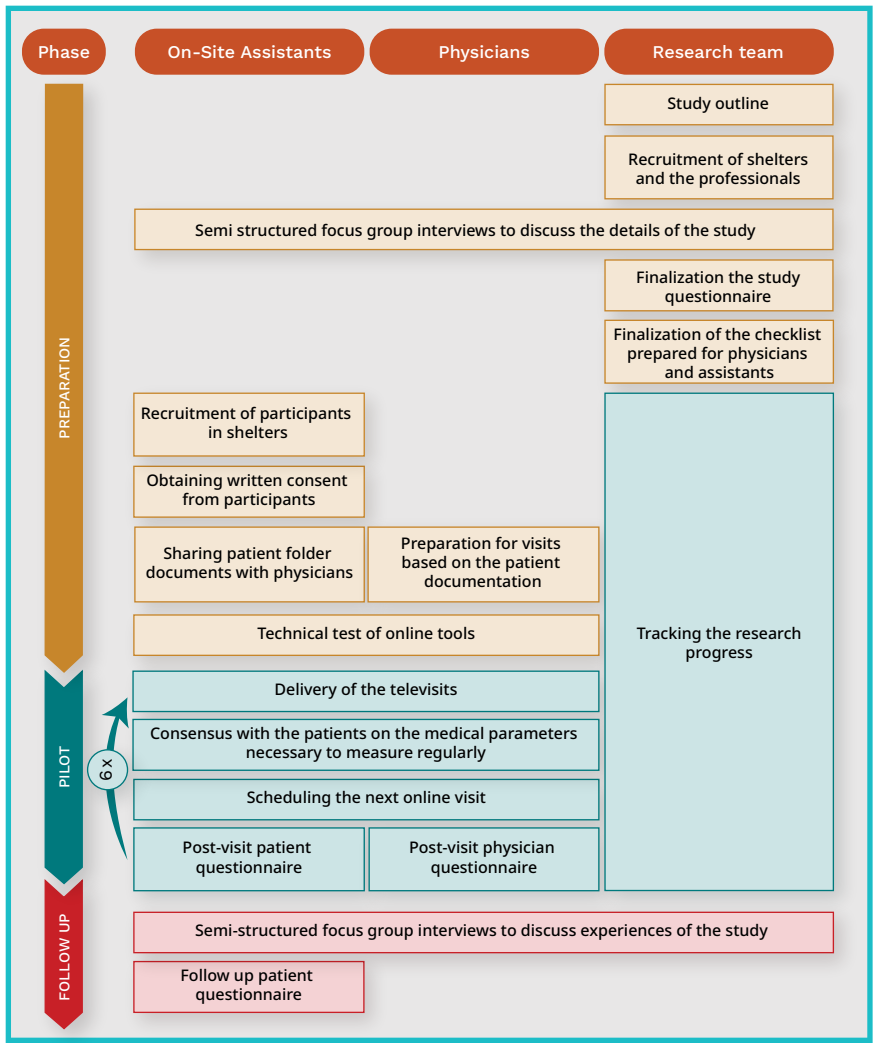

Figure 1: Process of planning and executing the telemedicine pilot priject

3) Digital Technology Access and Health-Related Internet Use

Between April and August 2021, with the help of the Hungarian Charity Service of the Order of Malta, the Digital Health Working Group administered a self-developed questionnaire to 662 homeless persons in 28 institutions in Budapest catering for the needs of homeless people.

Altogether, 6 types of institutions providing social services for homeless populations participated in the study. Although family shelters are not considered a part of the homeless social services according to the law in Hungary (these institutions are operated under the Child Protection Act), they were included in the study based on the housing instability of their clients and the temporary nature of the provided accommodation.

The topics for the questionnaire included access to digital technology, health-related internet use and digital skills. For some questions, a reference group was available for the sample from the Digital Health Working Group's previous research, a representative Hungarian population survey on digital health-related knowledge and attitudes with 1500 respondents which was published in December 2021.

As part of the quantitative analysis, we descriptively examined frequencies, averages, and percentage distributions. Use of technology and its various correlates (demographic variables and variables related to access to health services) were compared with a single variable analysis using Pearson chi-square test, with a significance level of $P<.05$. In the multivariate analysis, a binary logistic regression model was used. The method was used to examine the background factors for the question "Have you ever used the internet for health reasons?" which is the dependent variable.

4) Health Technology Access and Peer Support Among Digitally Engaged People Experiencing Homelessness: Qualitative Study

Between August 18, 2022, and October 27, 2022, a total of 12 in-depth semistructured interviews were conducted in 4 homeless shelters in Budapest, Hungary. The interview guide was based on the following topics: access to and attitude toward the health care system in general, access to and attitude toward digital tools in general and usage patterns of the internet and digital tools, and access to and attitude toward digital health and usage patterns of the internet and digital tools for health-related reasons. The interviews were conducted in Hungarian, with an average interview length of 30 minutes.

Purposive sampling was based on the following criteria: (1) presence in the social care system of the Charity Service of the Order of Malta, (2) use of the internet every second week or more frequently, (3) internet access with own smartphone, computer, or tablet or another device with a data contract, a pay-as-you-go facility, or free Wi-Fi, (4) self-rating of an average or more competent internet user, and (5) ever use of the internet for health-related reasons.

In the research process, 12 interviews were conducted, but in the final analysis, 10 interviews were included, which presented all the criteria of the purposive sampling specified above. Two interviews did not contain any reference to digital health usage.

Theoretical thematic analysis was used to analyze the interviews and identify patterns of themes: (1) familiarizing with the content of the data, taking notes, and making ideas for coding based on previous assumptions and following the interview guide, (2) generating initial codes manually, (3) identifying and indexing different codes across the data set manually, (4) creating relationships between the themes and subthemes, (5) defining, mapping, and naming themes, and (6) interpreting the results. The 3 researchers discussed and developed all themes and subthemes and clarified any discrepancies during the coding. Afterwards, they laid out the final thematic map in mutual agreement. The results were supported by participants' anonymized quotes.

5) State of Vulnerable Populations in the Techquity Framework in Hungary

In this paper, the Digital Health Working Group provided a secondary analysis of data representing a unique insight into different well-identified groups, all affected by the struggles of digital inclusion, namely people experiencing homelessness, elderly people, and people with long-term activity-limiting conditions.

The data for the analysis stems from the physician survey described above and conducted in 2021, especially data on elderly people, and people with long-term activity-limiting conditions, while data for people experiencing homelessness stems

from the digital technology access survey, the telemedicine pilot project, and the exploratory attitude survey described above in detail.

The secondary analysis had a methodology that represents the four-pillar model of techquity. For Pillar 1, the manifestation of trust as relevant openness toward or willingness to try new technology was applied. For Pillar 2, the research team considered access to technology as access to digital resources such as the Internet, smartphones, tablets, computers, and other digital tools. Initial use or adoption of the technology (Pillar 3) was represented in the data as frequency measurements: those respondents who used a digital resource at least once a month were considered adopters of the technology. Due to methodological constraints, it was difficult to indicate a separate measurement for access to health technology, initial usage, and adoption of the technology, therefore a combined data of Pillars 2 and 3 was presented regarding the three subpopulations. Under Pillar 4, the research team summarized data on self-defined recurrent or regular use of healthtech and compliance with telemedicine services.

Medical Students

To survey medical students, an online questionnaire research of students of general medicine at the 4 Hungarian medical universities (Semmelweis University - SE, University of Szeged - SZTE, University of Debrecen - DOTE, University of Pécs - PTE) between April and June 2021 (n = 542) was conducted.

The questionnaire was made available on Neptun, the official online unified educational channel used by all universities in Hungary, and on a social media interface (Facebook). For some questions it was possible to involve an open control group: we compared the results of the student research with the appropriate age group of the population sample (18-29 years old n = 270).

The research used qualitative and quantitative analytical elements (and principles) to obtain our results. Due to the nature of the questionnaire, we gave medical students the opportunity to provide predictive responses in short text form about the future of healthcare in 2050, in addition to Likert-scale response options, whereby the questionnaire provided a wealth of additional information about individuals' perceptions, in addition to the quantifiability of the data.

Quantitative Analysis

To interpret the scaled results, analysis of variance (ANOVA) was applied, focusing on group means to determine whether responses differed significantly across groups on specific questions. Post-hoc tests were subsequently conducted to further investigate the nature of these differences and to identify any outliers between groups.

This approach enabled us to explore general attitudes toward digitalization, responses to a (hypothetical) digital health initiative, perceived readiness for digital transformation, and the perceived openness to digitalization within healthcare environments, particularly among health professionals. Scale scores assessing these themes served as dependent variables.

The independent variables included respondent gender, variation across the four universities with a Faculty of General Medicine, and regional differences (defined by county, region, and geographical area) as well as differences by academic year. For the year-group variable, linear regression analysis was appropriate due to its continuous numerical nature, unlike the categorical structure of the other independent variables. Linear regression provided trend insights, revealing reliable associations between variables.

Qualitative Analysis

The questions that shape visions of the future were grouped through a thematic analysis conducted in multiple phases. Initially, data mining techniques were employed to identify the most frequently occurring keywords, which highlighted topics of primary interest to future physicians as indicated by the questionnaire responses. This process identified key themes, including administration, efficiency, private healthcare, preventive care, doctor-patient relationship workload, and economic capital. These themes enabled a deeper exploration of respondents' perspectives and attitudes on these critical issues within the analysis.

We then analyzed respondents' general attitudes toward the future based on their responses, resulting in five distinct groups: those with a distinctly positive

outlook, those with positive expectations, those with neutral expectations, those with a stable-neutral perspective (confident the healthcare system would remain largely unchanged), and those with negative expectations. Words signaling positive or negative emotions (e.g., “better” or “worse”) were critical in classifying these groups. Additionally, frequent use of words such as “hope” suggested intermediate sentiments, indicating respondents’ uncertainty about the future.

If responses lacked explicit statements or did not reveal a clear direction, they were classified as neutral. Using these categorizations, we developed a typology that effectively illustrates the prevailing perspectives of medical students regarding healthcare in 2050. By examining the questions and attitudes across these categories, we identified the themes most commonly emphasized in their responses.

Attitudes toward Artificial Intelligence among Medical Students

In the survey, conducted between November 2023 and February 2024, we examined the attitude of Hungarian university students toward artificial intelligence. We divided the questions into three larger blocks according to their main topic. In the first block, we asked their opinion about AI used in everyday life. In the second block, the questions were about introducing AI in education. Finally, in the last block, we asked their opinion about the use of AI in healthcare and medicine.

Our Google Forms survey was completed by 133 students, 47 men (35.3%) and 86 women (64.7%); their average age was 22.16 years. 45.9% (61 people) of the respondents live in a county seat, 18.8% (25 people) in a capital city, 13.5% (18 people) in a village, 12.8% (17 people)) in a small town for 4.5% and a big city for 4.5% (6 people each).

29.5% of those completing the course continue their studies in the field of medicine and health sciences (39 people), 15.9% in the field of teaching (21 people), 12.9% in the field of IT (17 people), 12.1% in the field of social sciences (16 people), 10.6% in the field of economics (14 people), 5.3% in the field of law, 5.3% in the field of humanities (7-7 people), 3.8% in the field of natural sciences (5 people), 3% in the field of technology (4 people), 0.8% in the art field and 0.8% in the agricultural field (1-1 person).

Qualitative Research among Physicians

In addition to the beforementioned quantitative study among physicians, a qualitative, interview-based study was also performed. This section provides details of its methodology.

62 semi-structured interviews were conducted by trained interviewers with several years of experience in fieldwork between October 2021 and June 2022. Purposive sampling was based on the following criteria: (1) physicians who are actively involved in patient care, (2) work in Hungary and (3) have experience in digital health solutions.

The interview guide was developed from the study aims and literature review. The interview guide was pretested on a physician sample (n=4) and modified based on their feedback. Interviewees were informed in a written form in advance of the purpose of the interview. Interviews were planned to be conducted face-to-face, but due to COVID19 pandemic most interviews were conducted via video call; the interviewers have made a prior telephone/email appointment with the interviewees. The interviewees signed an electronic consent form to confirm their voluntary participation in the research.

Interviews were audio recorded, with an average interview length of 60 minutes. All audio recorded interviews were transcribed verbatim and each transcript was anonymized and attributed a unique code. The interviewers checked the transcriptions for accuracy. Then, the final texts were sent back to each interviewee for confirmation.

For analysing the interviews, we used an inductive thematic approach: (1) familiarizing with the content of the data and taking notes and making ideas for coding, (2) generating initial codes, (3) identifying and indexing different codes across the data set, (4) reviewing themes creating relationships between the themes and subthemes, (5) defining , mapping and naming themes and (6) interpreting our results. 5 researchers discussed and developed all themes and subthemes and clarified any discrepancies during the coding. After then they evolved the final thematic map, which was laid down in mutual agreement. Our results were supported by anonymized quotes from different participants. All interviews were coded using Atlas.ti 6.0. software.

Social Media Analyses

In addition to the detailed quantitative and qualitative studies among physicians, social media content analysis was performed on specific Facebook groups according to the research question formulated in the chapter entitled Assessing the Needs of Online Diabetes Support Groups to Make Recommendations for Future Development. This section provides details of its methodology.

Data Extraction and Segmentation

We extracted 100 threads (posts and their first-level comments) from two Facebook groups (N=200); a thread constituted a source in our study. Data was scraped on March 16th, 2021 from the website and placed into individual sources (text files) containing a thread each. Only text data was collected; engagement data and message features, such as whether it contained photos/videos were not extracted because our research questions addressed text content only.

In the extraction process, sources were formatted to delimit post from comments and both post and each subsequent comment were separated by a newline character. Thus, our lowest level of segmentation was a turn-of-talk (post or comment), and a post-delimiter constituted mid-level segmentation. Every line received a unique utterance identifier (uid) and every thread received a unique thread identifier (tid). Our dataset contained a total of 1333 lines of data. Uids were generated using the Reproducible Open Coding Kit (ROCK) R package (available at: https://rock.science) and all of our coding and segmentation adheres to the ROCK standard. All sources were anonymized prior to coding and analysis.

Code Development

Discourse codes were developed inductively in several stages. We began by four researchers free-coding 10 threads and developing a preliminary codebook. Subsequently, these four preliminary codebooks were triangulated to create a tentative codebook, which was employed by the same four researchers to deductively code an additional 10 threads. Following this deductive coding stage, the four researchers triangulated their coded data and refined the codebook to create the final version. We juxtaposed the final version of our codebook to discourse codes we extracted from a precursory search in online diabetes support group-related literature published between 2018 and 2021, and integrated those. Our final code structure contained three parent and 16 child codes. The below table displays our code labels and a description for each, as well as our inter-rater reliability (IRR) scores.

Parent code	Child code	Kappa	Description
Activity	Ask4Help	1	Eliciting the opinions or experiences of others in the group
	GiveHelp	0.733	"Stating an opinion, own experience, recommendations in response to a demand"
	Soc_Supp	0.733	"Comforting, encouragement, congratulating, celebrating, reinforcing"
	Soc_Regul	0.733	"Assessing the quality and reliability of shared information; correcting, warning others about fraud or danger, negotiating validity of information"
	Share	0.845	Unsolicited sharing of personal information or external content
Appraisal	Dissat	0.727	"Satisfaction or dissatisfaction with a specific doctor, pharmaceutical, or the healthcare system in general"
	Satisfact	0.789	
Content	Instruments	0.775	"Tools used in diabetes care (e.g., blood glucose meter)"
	Lifestyle	0.842	"Recipes, healthy food, changes in body weight, exercise"
	Healthcare	0.831	Specific physician or the healthcare system in general
	Pharma	0.696	Insulin and strictly diabetes-related pharma products
	COVID	0.789	"Vaccine, disease, risk estimation"
	TestValues	0.776	"Disclosing blood glucose level, various parameters, or biomedical test result"
	Products	0.697	"Any prescription or over-the-counter drug, home remedy that is not part of conventional diabetes care"
	Trade	0.726	"Insulin-trade and barter of other diabetes-related drugs, products"
	Symptoms	0.723	"Side-effects of conventional or non-conventional diabetes care, symptoms of diabetes or comorbidities"

Table 1: *Final coding scheme, code descriptions, and inter-rater reliability (IRR) computed with Cohen's kappa (κ) for the two pairs of raters*

Coding

Codes were split among four researchers; a pair of raters "specialized" in the parent code Content and another pair of raters focused on Activity & Appraisal. To calculate IRR, we computed Cohen's kappa (κ) on 3% of the data (n=40 lines) for the codes designated to the two pairs of raters. For each of the 16 codes, the rate of agreement was above a minimum kappa threshold of 0.65. Subsequently, we employed the Interface for the Reproducible Open Coding Kit (iROCK) to deductively code the entire narrative corpus. Coding was performed on the level of lines; one line could receive any number of codes. Within the pairs, each individual coded 100 threads; the two coded versions of sources (threads) were then merged with the {rock} R package. Attributes (relevant characteristics of threads) were added to the merged text files; we logged the following attributes for each thread: group ID (case 1 or case 2), thread ID (tid), and date (year and month). Upon completing coding, we parsed all 200 sources with the {rock} package and exported them into a csv file constituting our final coded dataset. In this dataset, each row contained a line of data and every column represented a variable (attributes and codes). Attributes were displayed in categorical form, codes in binary form (0 if code is absent, 1 if code is present).

Analysis

We uploaded our final dataset into the Epistemic Network Analysis webtool to generate networks of code co-occurrences. We employed a weighted whole conversation stanza window to accumulate co-occurrences; model parameterization is displayed in Table 2.

Unit	GroupID>tid
Conversation	GroupID>tid>Post_Delimiter
Stanza window	(Weighted) Whole conversation
Codes	"Activity, Appraisal, Content codes"
Projection	"MR1: 5.3%, SVD2: 10%"

Table 2: *Parameters of networks generated with Epistemic Network Analysis (ENA)*

Our study was preregistered at Open Science Framework Registries. Our employed R script, detailed codebook, disclosed results, and extra visualizations can be openly accessed at our public repository.

As the reader can notice, we used different methodological approaches to capture the process of digital transformation in Hungary. However, an important limitation of each methodology used is that the study is cross-sectional, meaning it only presents the most important trends over a specific period of time.

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Experiences and Attitudes regarding Digital Health among Doctors

Key Messages

- Patients express a rather strong need to use digital technologies in healthcare.
- Cautious openness can be experienced among medical doctors in general, but they perceive the growing need coming from the patients.
- Younger doctors know and use more technologies and are generally more open to digital technologies, but this also means they are more aware of the disadvantages.
- General practitioners are much more open to technologies that facilitate patient communication and collaboration while showing less interest in technologies supporting clinical work.
- The uptake of digital health technologies requires the development of appropriate training and protocols, infrastructure development, and where appropriate, elaboration and use of incentives on an institutional and national level.

Introduction

Since 2016, the American Medical Association has conducted a triennial survey of physicians' views and attitudes towards digital health (American Medical Association, 2022). This longitudinal survey shows a dynamic increase in the number of physicians who see digital health as an overall positive opportunity. The adoption of digital tools is increasing regardless of gender, age, and specialty, and the greatest opening and positive shift in this 6-year cycle has been towards different areas of telehealth.

As of January 2024, there were 5.35 billion internet users globally (66.2 percent of the total global population). 5.04 billion (60.3 percent) use social media. 95.9 percent had a smartphone in January 2023, and 29.9 percent had a smartwatch or smart wristband. 9.24 million people have been using the Internet in Hungary at the start of 2024 when internet penetration stood at 91.8 percent. Hungary was home to 7.29 million social media users in January 2024, equal to 72.4 percent of the total population. A total of 11.26 million cellular mobile connections were active in Hungary in early 2024, equivalent to 111.9 percent of the total population.

Regarding infrastructure, Hungary has one of the best broadband coverage according to DESI (European Commission, 2023), however, the legislation on how it may be used, what can be financed, and what measures may be taken, was mainly lacking before the COVID-19 pandemic and only regulated issues around electronic health records data. Hence not a lot of doctors took the risk of engaging in this unregulated activity. As soon as the lockdown created the need for digital health the government issued 7 governmental and ministerial decrees regulating digital tool and service use and finance.

As there has been no similar research in Hungary before, we considered it important to assess the digital health situation among physicians in Hungary. In addition to the total sample of doctors, this chapter presents two topics that we have explored in more detail: general practitioners and non-general practitioners, and the different age groups of doctors.

Study Sample

This chapter presents the results of our medical survey. Survey data was collected between July 2021 and May 2022. The survey methodology is described in detail in the methodology chapter.

Here, we present the results not only in summary form, i.e. for the whole sample, but also compare GPs with doctors who do not work as GPs and make comparisons by age group. These two directions correspond to the ones we have investigated in our research, which have also been the subject of separate publications (GPs, young doctors), which are still under peer review at the time of writing this chapter.

GPs were defined as those doctors who identified GPs as their type of workplace. The age categories were based on age, showing the young age group (up to 35 years), the middle-aged (36-64) and the elderly. Here, the age limit is based on the retirement age in force. The data was analyzed using chi-square and ANOVA tests, with significant correlations always shown in light blue blackground color in the tables.

Results

Demographic profile

Before presenting the detailed results, it is worth examining the socio-demographic profile of the respondents, as shown in Table 1.

Demograpic profile of the respondents			Total medical doctors' sample	Non-GPs	GPs	35 years old at maxi-mum	36–64 years old	65 years old or older
Gender	male	n	658	500	158	151	351	156
		%	41.8%	43.1%	38.1%	37.8%	41.5%	47.1%
	female	n	917	660	257	249	494	175
		%	58.2%	56.9%	61.9	62.3%	58.5%	52.9%
	total		1575	1160	415	400	845	331

Demograpic profile of the respondents			Total medical doctors' sample	Non-GPs	GPs	35 years old at maxi-mum	36–64 years old	65 years old or older
Age	mean		49.80	47.76	55.52	30.10	50.74	71.16
Settlement type of workplace	capital	n	505	421	84	149	256	100
		%	32.2%	36.4%	20.3%	37.5%	30.4%	30.3%
	county seat	n	533	442	91	164	283	86
		%	33.9%	38.2%	22.0%	41.3%	33.6%	26.1%
	town	n	436	278	159	67	250	119
		%	27.8%	24.0%	38.5%	16.9%	29.7%	36.1%
	village	n	96	16	79	17	54	25
		%	6.1%	1.4%	19.1%	4.3%	6.4%	7.6%
	total		1570	1157	413	397	843	330

Knowledge of technologies

The differences between the various groups are already clearly visible in terms of technologies. The most known technology is participating in online conferences and trainings, which is known by almost 98 percent of the responding doctors. There is no significant difference between GPs and non-GPs in this respect, but in terms of age groups, the middle-aged group has a knowledge of this technology of over 99 percent (99.2 percent), while the other two age groups have a slightly lower knowledge. In the survey period, the conferences and other professional training programs were online due to COVID-19 restrictions, so this explains the high profile of these online events.

In terms of awareness, this is followed by tracking international literature, trends, and data online, which has an awareness of over 90 percent, but it is worth noting that the awareness of this technology is 82 percent among GPs, and in terms of age, the awareness is below 80 percent - 79.3 percent in the oldest age group.

It can be seen that, compared to the overall sample, GPs have a higher awareness of telemedicine, remote visits, healthcare-related social media, communication with patients, information sharing technologies, but significantly lower awareness of augmented reality (e.g., surgical practice), use of virtual reality (e.g., pain management, psychotherapy), 3D printing (e.g., dental, surgical solutions), artificial intelligence solutions in medical decision-making (radiology, pathology, ophthalmology, diagnostic solutions), robotics (e.g., surgical robots, disinfection robots, delivery robots) and nanotechnology (e.g., ingestible diagnostic devices). The technologies that GPs are more familiar with and use are also more widespread in general and are much better suited to the care they provide.

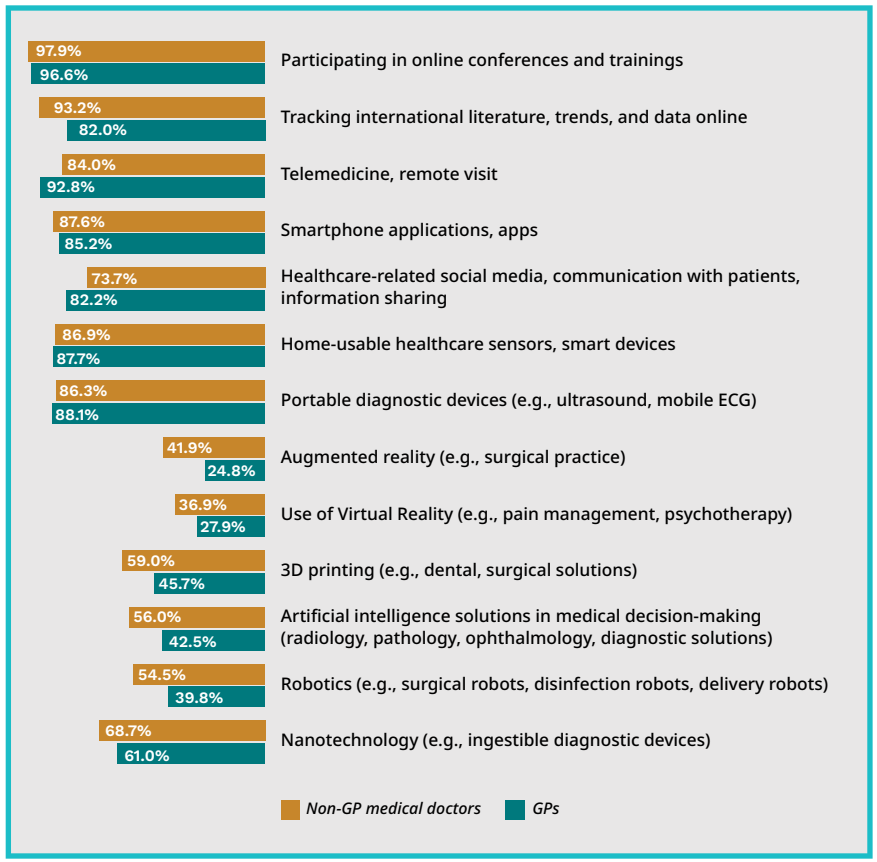


Figure 1: Knowledge of technologies

In all cases, except for online conferences, the youngest age group is the most informed.

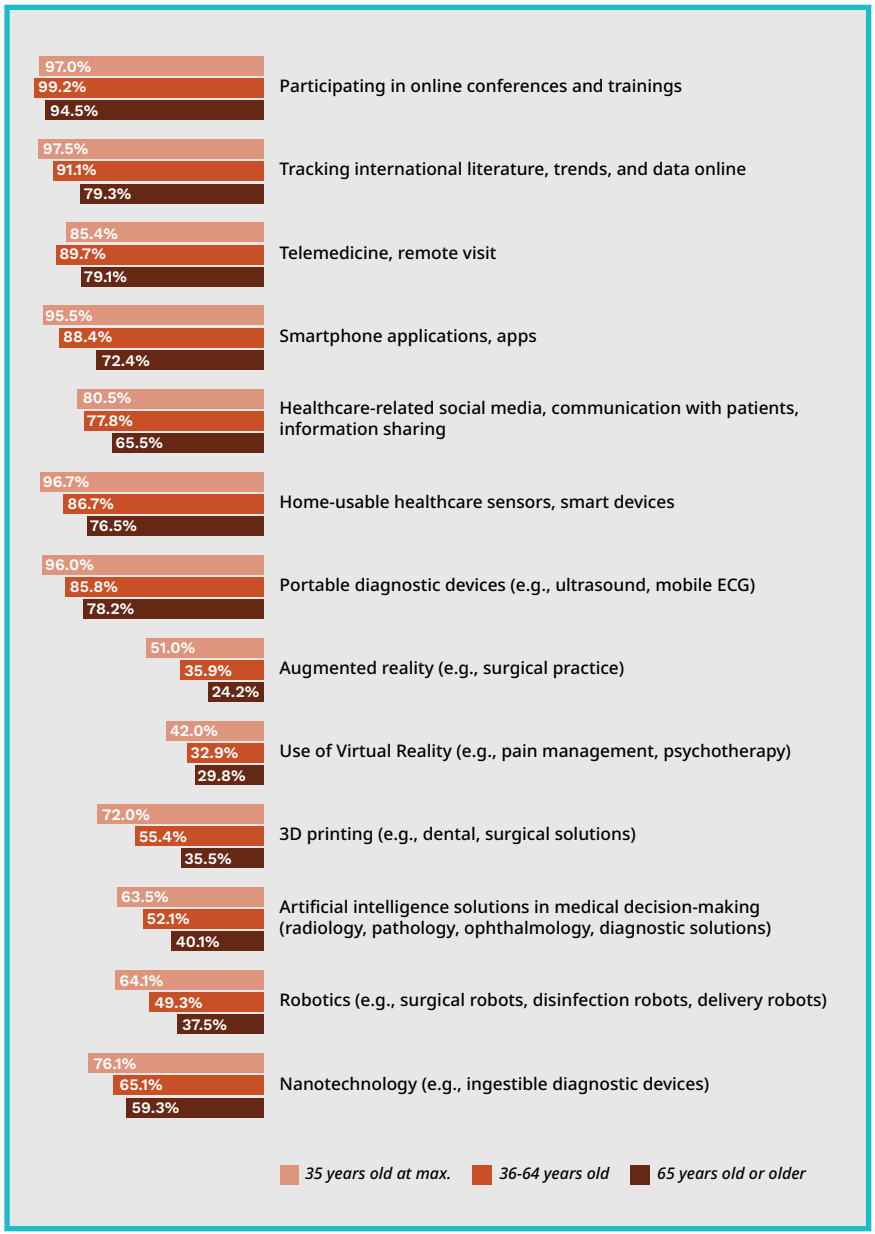


Figure 2: Knowledge of technologies

Use of technologies

After learning about these technologies, the next topic is the use of these technologies. The most used technologies in the overall sample are tracking international literature, trends, and data online (45.7 percent), smartphone applications (44.1 percent), and participating in online conferences and trainings (35.9 percent). The most used technologies among GPs are telemedicine, remote visits, healthcare-related social media, and portable diagnostic devices. No significant difference is seen in participating in online conferences and trainings and home-usable healthcare sensors and smart devices, with significantly fewer GPs than non-GPs using the other technologies.

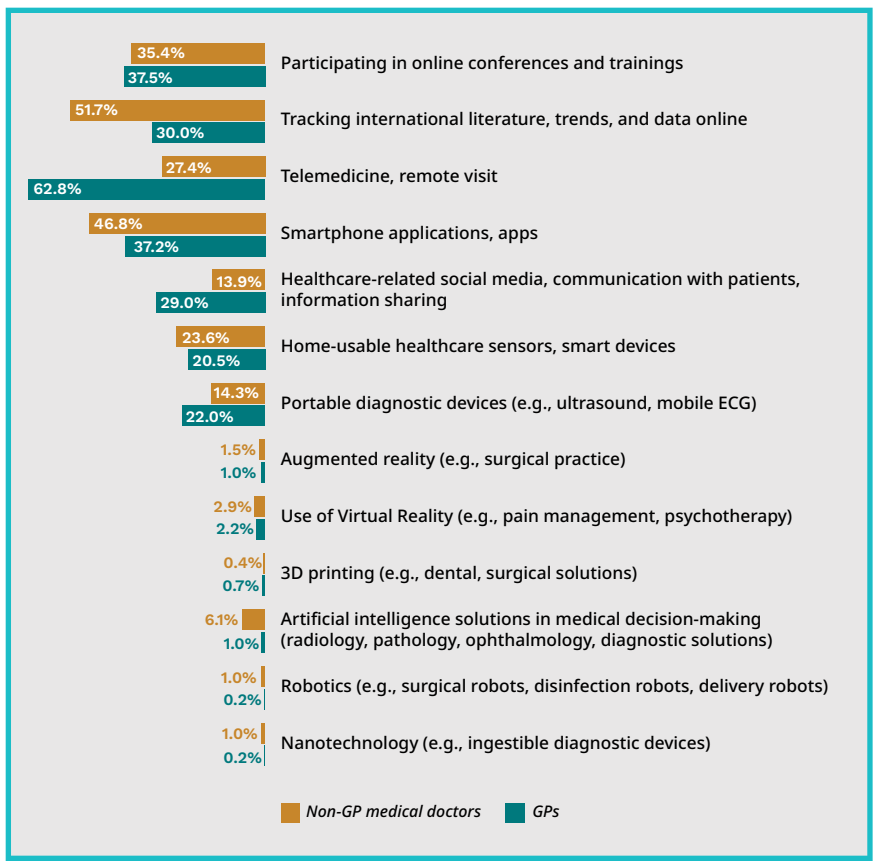


Figure 3: Use of technologies

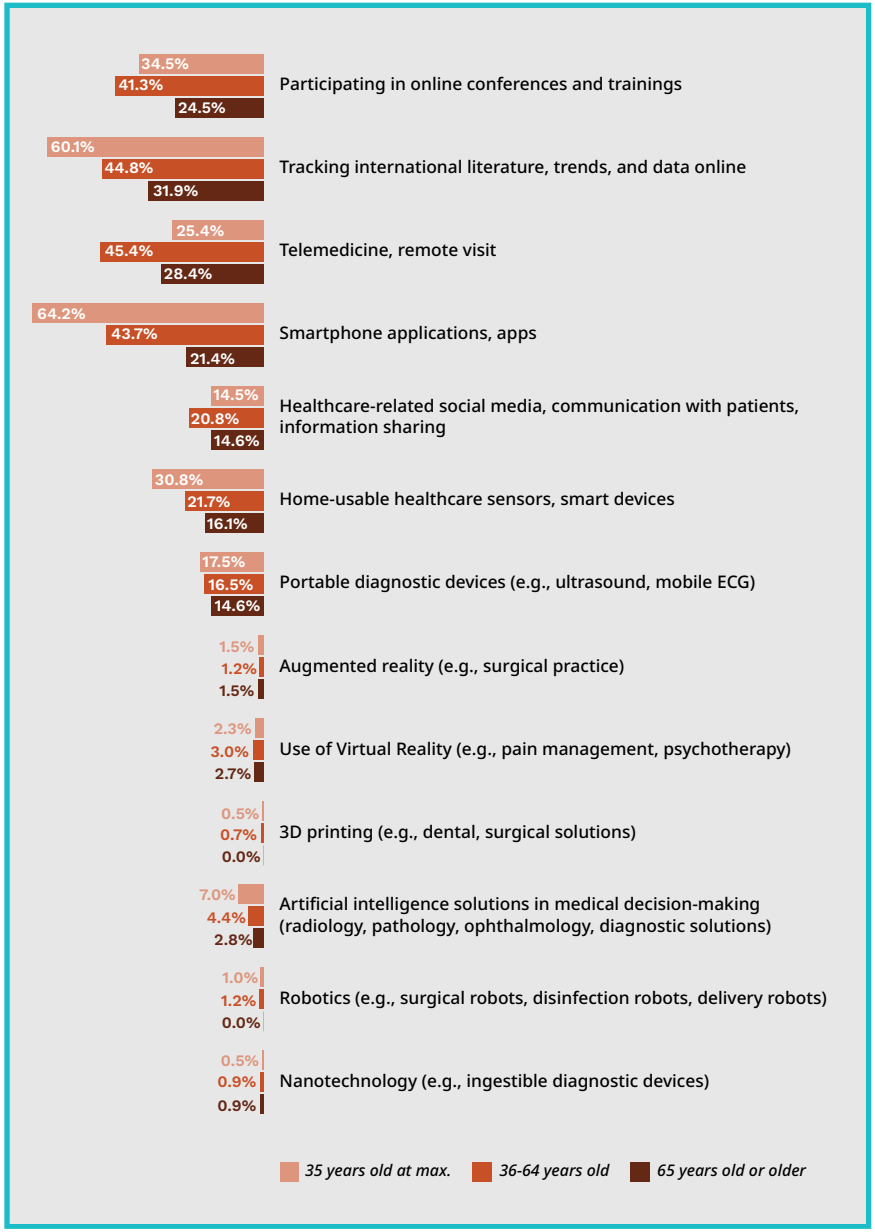


Figure 4: Use of technologies

By age group, what we saw for technology awareness is also true here, i.e. all other technologies except participating in online conferences are used significantly more often by the youngest age group and less often by the oldest age group.

The intention of digital technology use in the next 3 years

The next topic related to technologies is the intention to use them in the next 3 years. Tracking international literature, trends, and data online (65.4 percent), participating in online conferences and trainings (60.3 percent) and smartphone applications, apps (56.2 percent) are the most popular, with more than half of respondents intending to use them in the next 3 years. There are two technologies that GPs would prefer to use more than non-GPs, these are telemedicine, remote visits (62.7 percent), and healthcare-related social media, communication with patients, and information sharing (35.0 percent).

It is important to mention that the Hungarian telemedicine legislation changed at the beginning of the COVID-19 epidemic, creating the legal conditions for its use in practice. Thus, patients and doctors have become familiar with these options and can see their benefits, which may encourage future use.

By age group, the younger the age group, the higher the openness, except for telemedicine, and remote visits (49.3 percent), as the middle age group is the most open (53 percent).

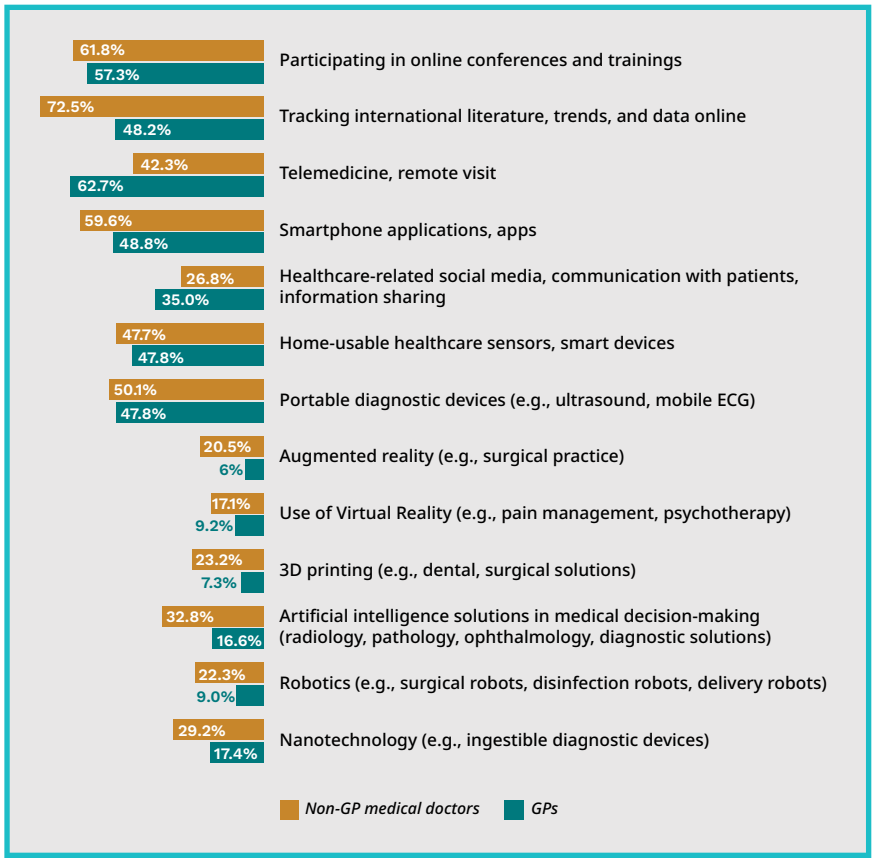


Figure 5: Intention of usage of digital technologies in the next 3 years

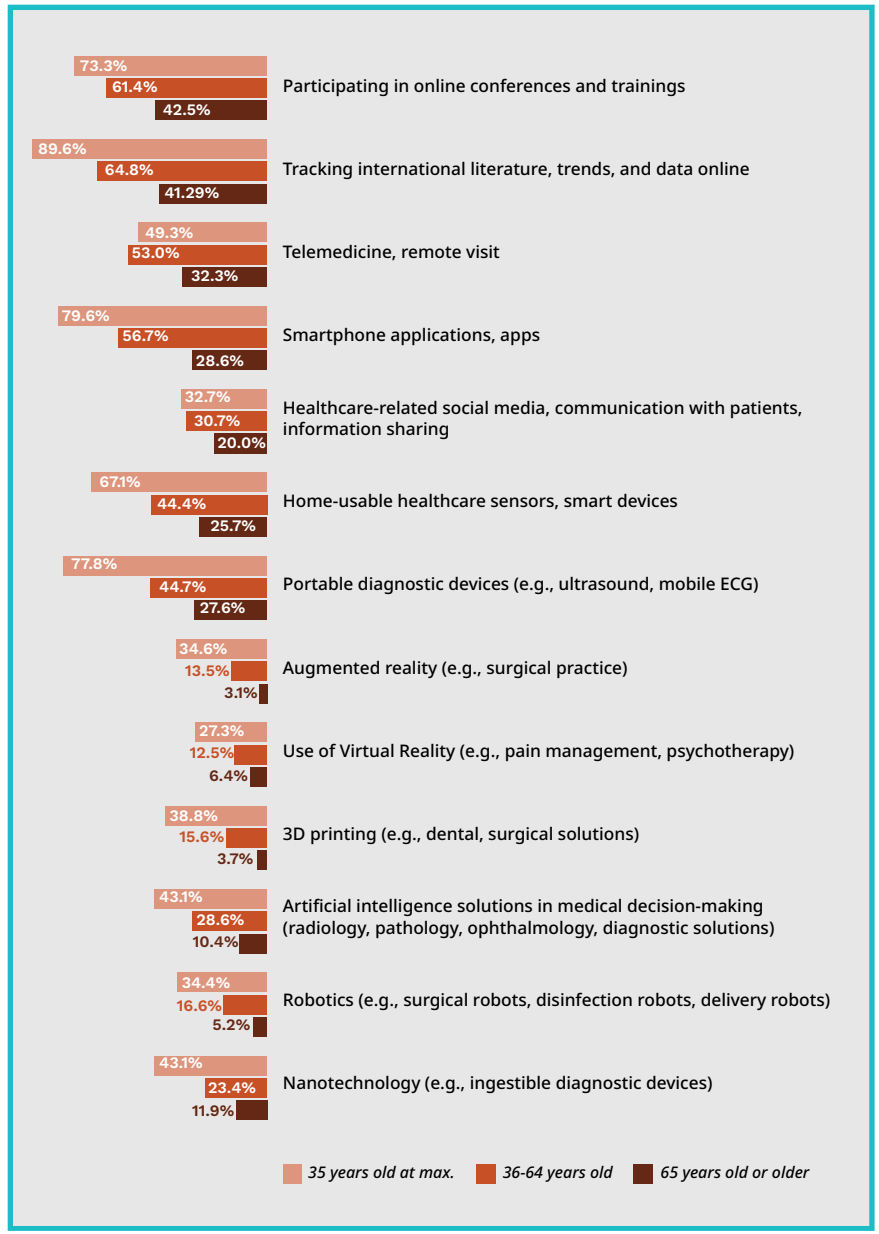


Figure 6: Intention of usage of digital technologies in the next 3 years

Recommendations for patients

An important question in our research was whether doctors recommend modern digital information sources and solutions to their patients. Of all respondents, 78.8 percent had already recommended a website to their patients, significantly higher for GPs at 88.8 percent. By age group, it is interesting to note that 80 percent of the middle-aged group have already recommended a website, but the proportion is lower for both the youngest and the oldest.

More than half of doctors (52.8 percent) have recommended a mobile app to their patients, and the proportion is higher for GPs, with almost two-thirds (65.5 percent), and by age, we see a similar pattern to the recommendation of websites, with the middle-aged group having the highest proportion.

We also see a similar pattern for social media resources, with less than half of the total sample (46.0 percent) having recommended one, compared to over 60 percent (60.4 percent) for GPs. By age group, the difference is not as striking as for the other two tools, but the pattern is similar, although the oldest age group lags less behind the middle-aged (48.3 percent and 46.4 percent respectively).

Have you recommended website, app, social media source/group to patients?		Total medical doctors' sample	Non-GPs	GPs	Maximum 35 years old	36-64 years old	65 years old or older
Recommending a website to patients	n	1236	870	366	306	684	246
	%	78.8%	75.3%	88.8%	76.7%	81.2%	75.2%
Recommending an app	n	825	555	270	190	473	162
	%	52.8%	48.3%	65.5%	47.6%	56.3%	50.0%
Recommending a social media source/group to patients	n	717	468	249	162	404	150
	%	46.0%	40.8%	60.4%	40.6%	48.3%	46.4%

How doctors perceive patients' needs

In our research, we also sought to assess what doctors perceive their patients' needs to be regarding digital health tools. Of course, we we also asked the patients - more about them in another chapter.

More than eight-tenths (80.8 percent) of the doctors who responded experienced that their patients have the need to communicate via email, followed by sharing and discussing images and test results, which was the second most frequently mentioned need with 74.9 percent, and scheduling appointments online with 63.9 percent. Given that GPs have a very different relationship with patients and the care they provide is typically longer term than specialists in other specialties, it is a fascinating question how much they differ from non-GPs in terms of their needs. GPs experienced significantly higher levels of demand from their patients for all needs except scheduling appointments online and recommending websites with valid medical information. Most strikingly, for email communication, nearly 95 percent of GPs said they had experienced this need from their patients, and for sharing and discussing images and test results, the need was over 85 percent (86.7 percent).

There is no significant difference between age groups in the need for sharing and discussing images and test results. However, it is interesting to note that in most cases the younger age group did not report the highest number of patient needs. In e-mail communication, the youngest age group reported the least, with the middle and oldest age groups both reporting over 85 percent (86.3 percent and 85.5 percent) of such needs. The reason for this might be that the younger age groups would like to use other communication channels than e-mail (e.g. instant messaging). Although with lower rates, a similar pattern is seen for online appointment booking and teleconsultation. However, for the claims: monitoring changes in their health status through their smartphones, using home health sensors, recommending websites with valid medical information, and using social media for communication with you, the youngest age group is the one that reported the highest proportion of patient claims. Is it possible that patients are also matching their needs to the doctor? So, are younger doctors more expected to use modern technological tools? The results certainly show this. Furthermore, the way doctors behave and use technology can influence what patients expect of them, but some basic needs are already ubiquitous: emailing, and sharing documents online. But beyond that, it's what the doctor uses that counts: they may be more likely to express their digital health needs if they see an openness to technology.

Have you experienced patient need for the following digital health tools?		Total medical doctors' sample	Non-GP medical doctors (n=1160)	GPs (n=415)	Maximum 35 years old	36-64 years old	65 years old or older
Email communication	n	1273	879	394	262	729	282
	%	80.8%	75.7%	94.9%	65.7%	86.3%	85.2%
Scheduling appointments online	n	1007	729	278	221	578	208
	%	63.9%	62.8%	67.0%	55.4%	68.4%	62.8%
Sharing and discussing images and test results	n	1180	820	360	298	647	235
	%	74.9%	70.7%	86.7%	74.7%	76.6%	71.0%
Teleconsultation (via Skype or video chat)	n	759	531	228	164	443	152
	%	48.2%	45.8%	54.9%	41.1%	52.4%	45.9%
Have you experienced patient need for the following digital health tools?		**Total medical doctors' sample**	**Non-GP medical doctors (n=1160)**	**GPs (n=415)**	**Maximum 35 years old**	**36-64 years old**	**65 years old or older**
Monitoring changes in their health status through their smartphones	n	363	246	117	118	187	58
	%	23.0%	21.2%	28.2%	29.5%	22.1%	17.5%
Using home health sensors	n	293	195	98	87	165	41
	%	18.6%	16.8%	23.6%	21.8%	19.5%	12.4%
Recommending websites with valid medical information	n	636	453	183	180	364	93
	%	40.4%	39.1%	44.1%	45.0%	43.1%	28.1%
Using social media for communication with you	n	583	388	195	165	346	71
	%	37.0%	33.4%	47.0%	41.4%	40.9%	21.5%

Needs to use digital health technologies

The use of digital health tools requires several conditions, including training, knowledge transfer, and technological and infrastructural background. In our survey, we also asked doctors about this. Financial incentives were the most frequently cited need, with more than two-thirds of respondents (68.3 percent), followed by availability and accessibility of technologies (67.2 percent) and dedicated time within working hours (67.2 percent), which are needs that can largely be met through regulation and incentives. This is in line with our findings in our qualitative study, where it turned out that work-life balance could be better ensured with dedicated time for using digital communication tools within working hours, and this might be institutionalised through governmental or institutional policies, as well as strong individual work-life balance boundarysetting and maintenance.

In general practice, the pattern is slightly different from the overall sample. Significantly more GPs, more than three quarters (76.4 percent) indicated financial incentives and significantly more GPs indicated training: postgraduate training (39.8 percent) and other training opportunities (49.6 percent), and more GPs thought that patient engagement was also a need (49.9 percent). Conversely, a lower number of GPs indicated that the availability and accessibility of technologies would be necessary, although this proportion is still above 60 percent (63.6 percent), and the need for evidence-based research was indicated by a third of GPs.

When broken down by age group, the younger age group ticked most of the factors more highly, except for postgraduate training. As they are presumably more open to the use of modern technologies, they are more aware of the needs that arise.

Postgraduate training, on the other hand, was the most highly cited by the oldest age group, with 47.7 percent responding, meaning that there is a need among them to learn to use technology, which is certainly welcome.

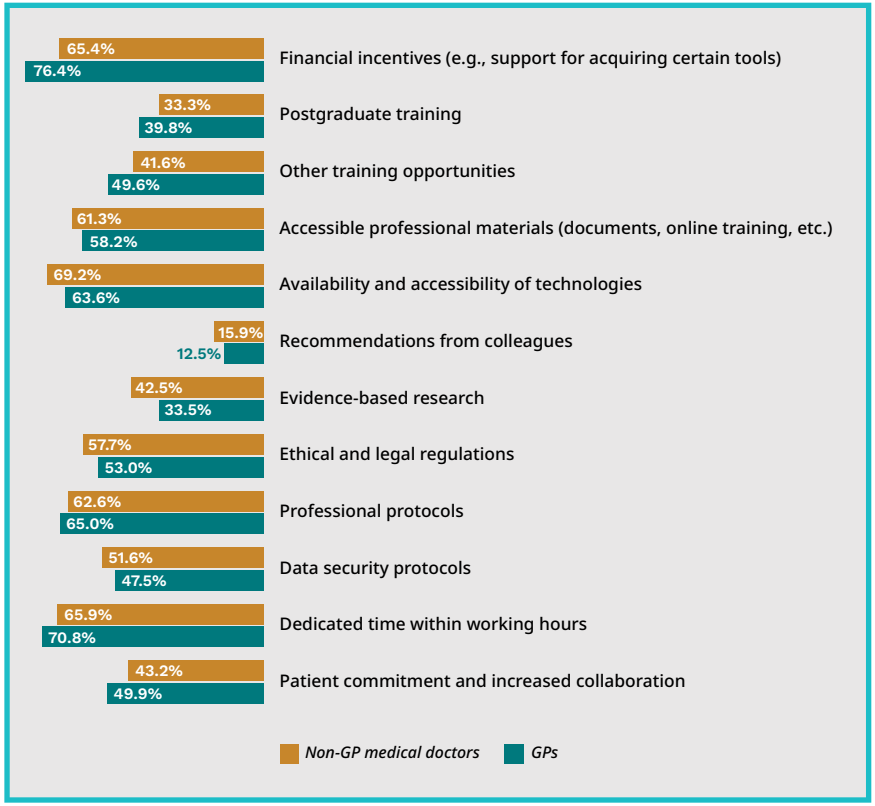


Figure 7: Needs to use digital health technologies

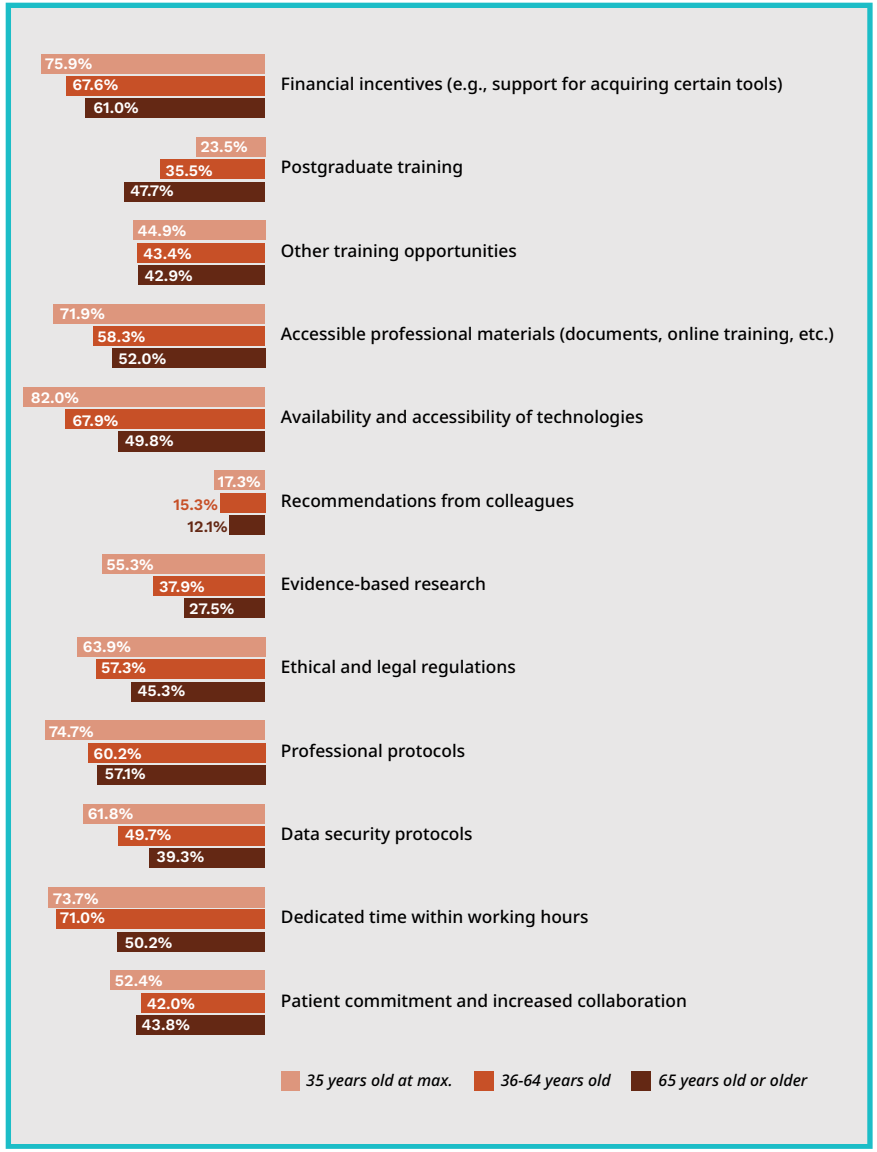


Figure 8: Needs to use digital health technologies

Perceived advantages and disadvantages of digital health solutions

The last major theme of our questionnaire survey is the perceived advantages and disadvantages of using digital health solutions. The perceived benefits are presented below, followed by the perceived disadvantages. Of the perceived benefits, the doctors who responded most frequently cited improved efficiency (69.2 percent), convenience (68.6 percent), and saving time for the patient (64.4 percent).

Significantly more GPs responded positively to improved diagnostic capabilities (48.2 percent), the reduction of the number of in-person doctor-patient meetings (69.6 percent), and that it made work more efficient (56.9 percent), and fewer responded that it is convenient (63.1 percent), saves time for the doctor (52.3 percent) and reduces the likelihood of errors (15 percent).

Broken down by age group, the youngest age group had a significantly higher choice of each item, while the oldest age group had a lower choice of each advantage.

In terms of disadvantages, the most frequently chosen disadvantages in the overall medical sample were misinterpretation of shared health data by patients (67.6 percent), increased administrative burdens on doctors (52.3 percent), and an increased possibility of misunderstandings in doctor-patient communication (49.8 percent). Among the perceived disadvantages, significantly more GPs selected frustration among patients (26.3 percent), increased administrative burdens on doctors (60.0 percent), additional costs for practices (45.5 percent), and an increased likelihood of burnout (15.4 percent), and significantly fewer selected potential for overdiagnosis (26.7 percent), misinterpretation of shared health data by patients (59.3 percent) and faulty technology jeopardizing patient recovery (20.7 percent).

When comparing age groups, where there is a statistically significant difference between age groups, the youngest age group always chose the disadvantages in the highest proportion, so they are more aware of the disadvantages as well as the advantages.

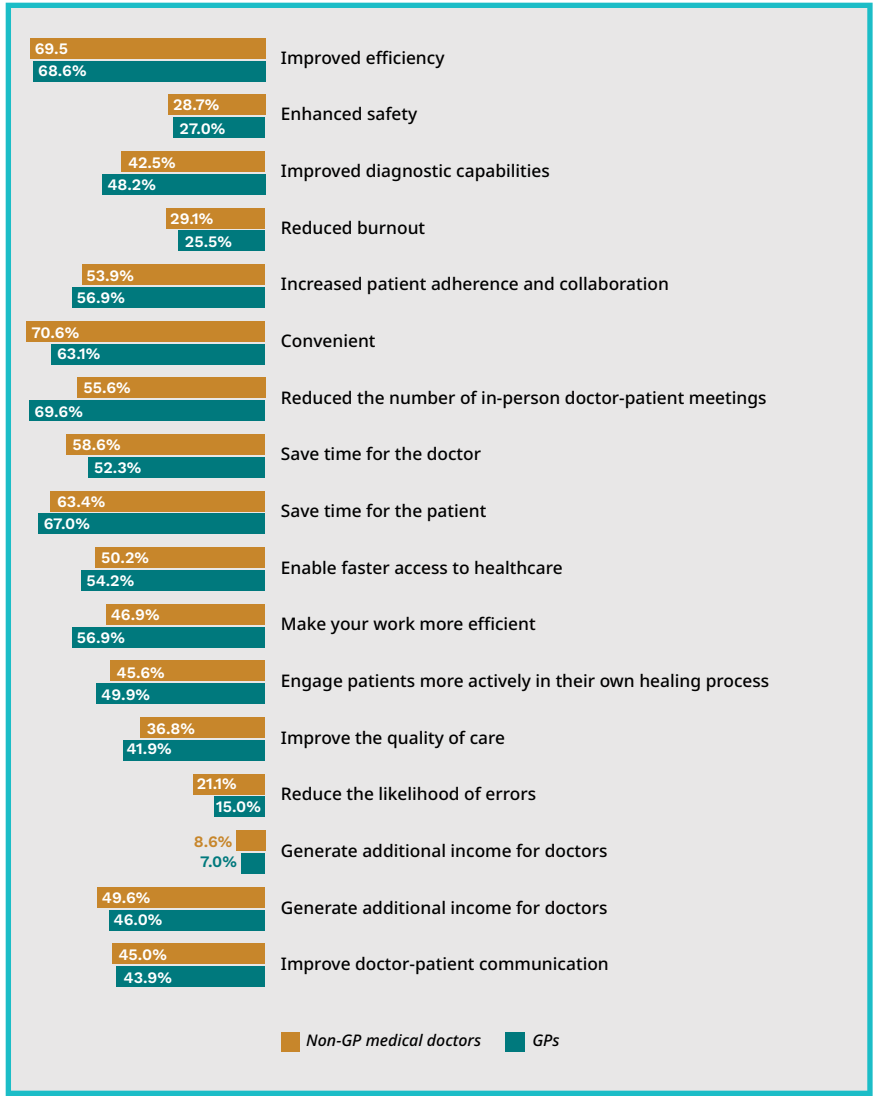


Figure 9: Perceived advantages of digital health solutions

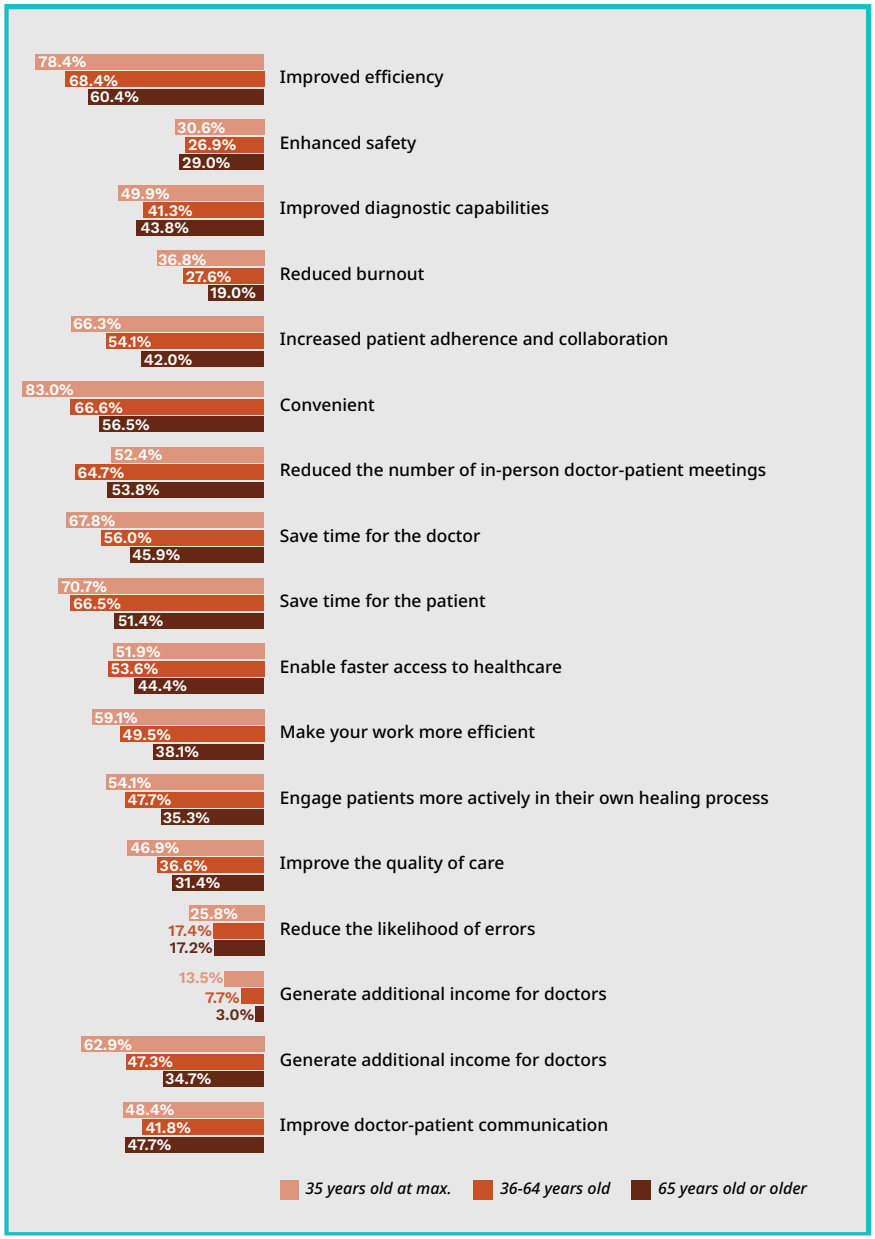


Figure 10: Perceived advantages of digital health solutions

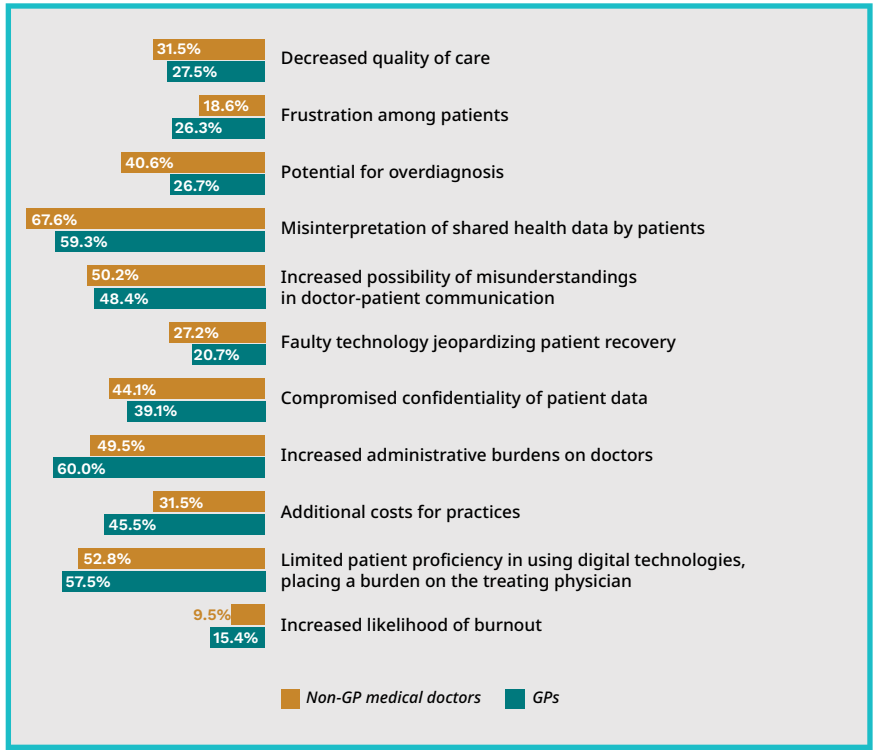


Figure 11: Perceived disadvantages of digital health solutions

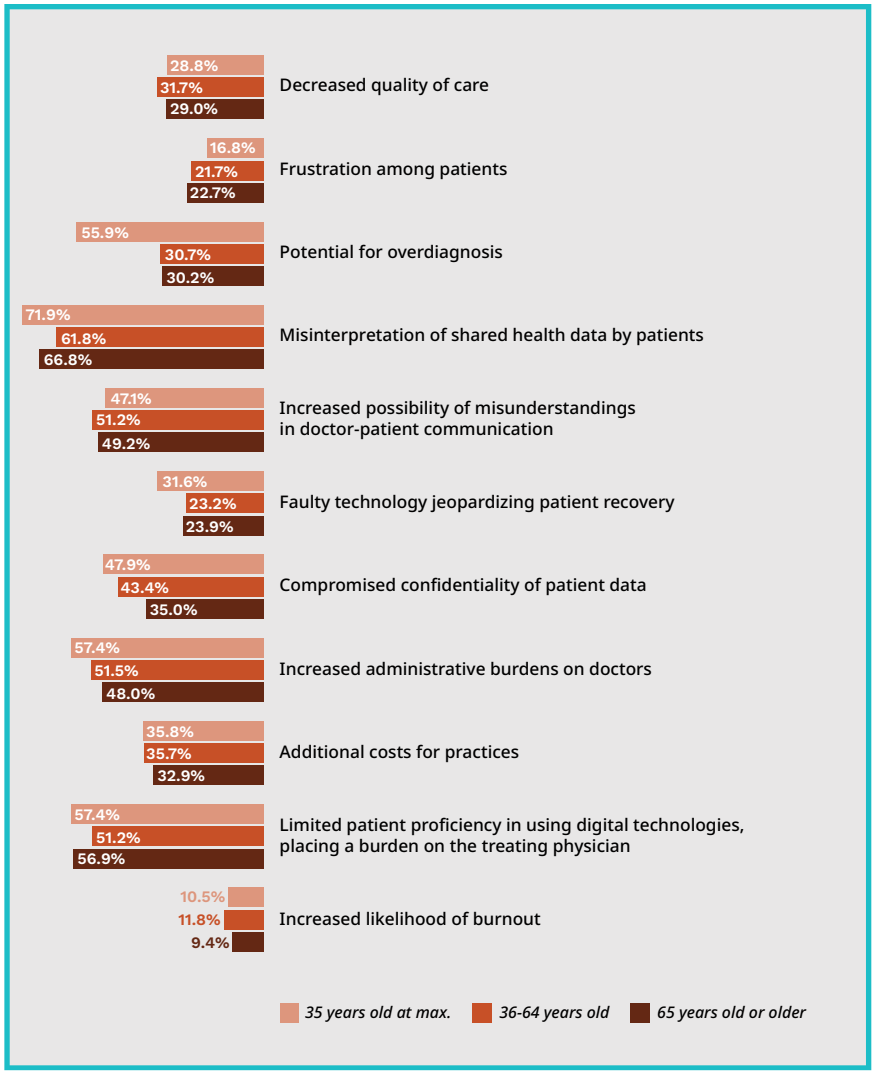


Figure 11: Perceived disadvantages of digital health solutions

Conclusions

The results presented here show that digital health technologies became an integral part of care, keeping in mind that the limitations caused by the COVID epidemic have certainly played a major role in accelerating the adoption of digital health tools by doctors in Hungary.

It can be observed that general practitioners are much more open to technologies that facilitate patient communication and collaboration while showing less interest in technologies supporting clinical work. In part, this may stem from the nature of primary care medicine. Primary care in Hungary is not highly technology-based. The core of primary care lies in effective communication with the patient and determining whether further evaluation or specialist referral is necessary. Accordingly, the digital health solutions employed in this context focus on enhancing communication and facilitating collaboration.

An interesting phenomenon concerning patient needs is that patients seem to match their needs to their doctor because they expect different things from a younger and an older doctor. The question of whether a need comes purely from the patient or whether doctors are the catalyst for this process in the first place needs further, deeper analysis. A related important phenomenon is that older doctors seem to be more open to training and acquiring knowledge related to technology, which is certainly important information for professionals and policymakers, as in many cases it is the knowledge that is most lacking for the use of technology. This is also visible when we report on the factors that are necessary for the use of digital health tools.

Younger age groups are more familiar with and use more technologies, they are more open to digital technologies, but this also means that they are more aware of the downsides of technology, i.e. they are more aware of the advantages, as well as the disadvantages.

In relation to this, while a significant proportion of the oldest-old are aware of various technologies, they use few of them. However, they demonstrate a need, openness, and willingness to adopt these technologies in the future. This could be encouraged through knowledge transfer, technical material, and access to technology, or even by setting up cooperative schemes whereby young people with more experience help older people. This could lead to the development of strong professional links, not only in the digital field, but as older people can also in turn support younger people with their professional experience, which would benefit older people, younger people, and indeed the whole care system.

It is crucial to draw attention to the fact that health policymakers need to actively support the wider adoption of digital tools, whether through knowledge dissemination, protocol development, or infrastructure enhancement.

The survey was conducted during the COVID-19 pandemic, which inherently influenced the attitudes of doctors towards digital technologies. In the near future, it will be necessary to assess the post-COVID digital healthcare landscape, as it will reveal the true impact of the pandemic and what remains after its effects subside.

The results of the medical survey presented above can also be interpreted and contextualized together with our medical student survey, dental student survey, and the results of our qualitative study.

References

American Medical Association. (2022). *Digital Health Research. Physicians' motivations and key requirements for adopting digital health adoption and attitudinal shifts from 2016 to 2022.*

European Commission. (2023). *The Digital Economy and Society Index (DESI).*

Girasek, E., Boros, J., Döbrössy, B., Győrffy, Zsuzsa (2023), E-orvosok Magyarországon: Digitális egészséggel kapcsolatos tapasztalatok és vélemények a hazai orvosok körében. (E-physicians in Hungary: Experiences and opinions related to digital health among Hungarian physicians). Orvosi Hetilap (Hungarian Medical Journal) 164(4) 132-139. https://akjournals.com/view/journals/650/164/4/article-p132.xml

Győrffy, Zs., Döbrössy, B., Girasek, E., Boros J., Unveiling the Digital Future: Perspectives of Physicians Under 35 years old on E-health Solutions -- under peer review

Girasek,E., Döbrössy, B., Boros, J., Győrffy Zs., Embracing the Digital Health Era: Exploring the Role of Hungarian General Practitioners as Digital Gatekeepers in the Utilization of Digital Health Solutions - A Mixed Method Study -- in press: BMC Primary Care

Orsolya Németh

The Impact of Digital Healthcare and Telemedicine on Dentistry

Key Messages

- Teledentistry enhances patient care by providing a serene environment that reduces anxiety and fear, improving the overall patient experience. Pre-knowledge of medical and dental history through teledentistry enables dentists to be well-prepared for initial face-to-face visits, leading to enhanced efficiency and patient care.
- Effective utilization of teledentistry allows for monitoring oral mucosa changes, promoting dental confidence, and fostering proper oral care habits in patients of all ages.
- Integrating teledentistry into dental education is crucial for future dentists to adapt to the evolving digital healthcare landscape and ensure quality patient care in the upcoming decade.
- Teledentistry in education offers advanced learning opportunities through self-instruction and interactive videoconferencing, enhancing educational experiences for dental professionals worldwide.
- Teledentistry aids in clinical training by allowing students to learn various aspects of dental practice remotely, ensuring continuity in dental education and patient care during critical times like the COVID-19 pandemic.

Introduction

Generally speaking, telemedicine was not proportionally significant before the coronavirus epidemic (Németh, 2021a), even in countries where very substantial steps had been taken to digitalize healthcare and where considerable geographical distances absolutely justified the introduction of telemedicine. The COVID-19 outbreak attracted attention to the possibilities of telemedicine. In support of stopping the spread of the novel coronavirus infection, while keeping healthcare systems running and minimizing the risk of being infected, both international and national data proved that telemedicine could play a major role in the triage process, early identification, diagnosis, and treatment of infected individuals, and the management of patient pathways. (Smith et al., 2020). It also played an important role in remote monitoring of medical conditions and care of patients with chronic diseases. It successfully reconnected vulnerable groups of healthcare personnel to the care system (Ghai, 2020).

The use of telemedicine in epidemics and extreme situations is not a new phenomenon: after the 2003 SARS pandemic, China developed its telemedicine capacity (Chen et al., 2005), Australia developed a strategy for mental health assistance after bushfires (Mariño & Ghanim, 2013), the American Telemedicine Association Emergency and Response Special Interest Group developed an action plan on disaster response options (American Telemedicine Association, 2014), and the NATO Multinational Telemedicine System developed scenarios for extreme situations (NATO Centre of Excellence for Military Medicine, 2011). Nevertheless, the pandemic has required global effort, taking the use of telemedicine to a whole new level. In the month after declaring a state of emergency, Hungary's government allowed online visits and remote consultations in publicly financed primary and specialty care, creating the legal basis for telemedicine (Hungarian Government, 2020). The Electronic Health Service Platform (EESZT) promoted "store and forward" technologies, teleconsulting, and remote diagnostics (National Healthcare Service Center, 2020). Various domains such as urology, dermatology, diabetology, and pediatrics have utilized telemedicine to address specialty care needs during the SARS-CoV-2 pandemic (Győrffy et al., 2020). Telemedicine can reduce workload, help healthcare professionals maintain mental balance, and prevent or alleviate burnout syndrome (Greenhalgh & Wherton, 2020).

The introduction of teledentistry in Hungary was finally made inevitable by the restrictions introduced in March 2020, when the government decree limited the work of dentists to emergency dental care.

The teledentistry system has successfully debuted in three areas:

1. as pretriage so that patients only visit the clinic for definitive care when it is essential.
2. for patients undergoing orthodontic treatment and those with oral mucosal lesions, where remote monitoring is possible using teledentistry. In this case, patients upload an image or images.
3. Teledentistry can be used to reach the general public and raise awareness of health-conscious behaviour among patients whose care can be delayed, and to carry out primary prevention activities.

In the past, most patients enquired by telephone and e-mail and in many cases had to visit the Department of Community Dentistry in person (Németh, 2021b). However, with the introduction of teledentistry, it is hoped that the number of telephone inquiries and unnecessary doctor-patient encounters can be significantly reduced, leading to more efficient care and the follow-up of mucosal lesions requiring prevention and chronic, ongoing monitoring. The rapid and efficient introduction of teledentistry could be a perfect domestic example of the use of telemedicine during COVID-19 (Nemeth et al., 2021).

Dentistry is entering a new era marked by digitalization (Estai et al., 2018). Digital dentistry or teledentistry, has already been implemented in practice, however, only a limited number of options are taken into account. In addition to digital workflows, patient communication, AI, and online forums are also available. Telemedicine services can replace face-to-face visits; consequently, the most significant emphasis is placed on doctor-patient communication, such as store-forward, remote patient monitoring, patient follow-up, discussion, and review of results. Digital dental workflow is taking its place as the traditional dental process disappears. Imaging equipment such as intraoral scanners, extraoral scanners, and cone beam computed tomography (CBCT) can convert the morphology of a patient's tissues into three-dimensional (3D) information. Using computer-assisted milling technologies and 3D printing, surgical implant guides or dental prostheses can be created in as little as one hour. The

future of dentistry will continue to be shaped by the revolution of digitalization in the medical industry. Nonetheless, let us mention the dental specialties where digital patient monitoring with preventive and communication apps expedites patient treatment as a revolutionary strategy.

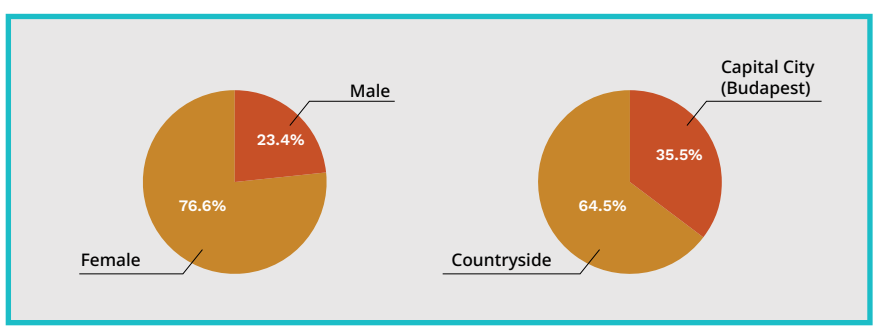
There is still more to learn about the state of teledentistry in Hungary, especially concerning dental professionals' understanding and application of the field. That's why an online survey of Hungarian dentists was undertaken. The online questionnaire was self-administered and available for three months. The research team created a questionnaire to compare the results to our population-based survey (Németh et al., 2023). Our research contributes to the existing knowledge by looking into the intricacies of teledentistry use among Hungarian dentists. Our study is unique because it assesses awareness, utilization, and perceptions of several teledentistry tools, providing insight into a previously unexplored area in Hungarian dentistry.

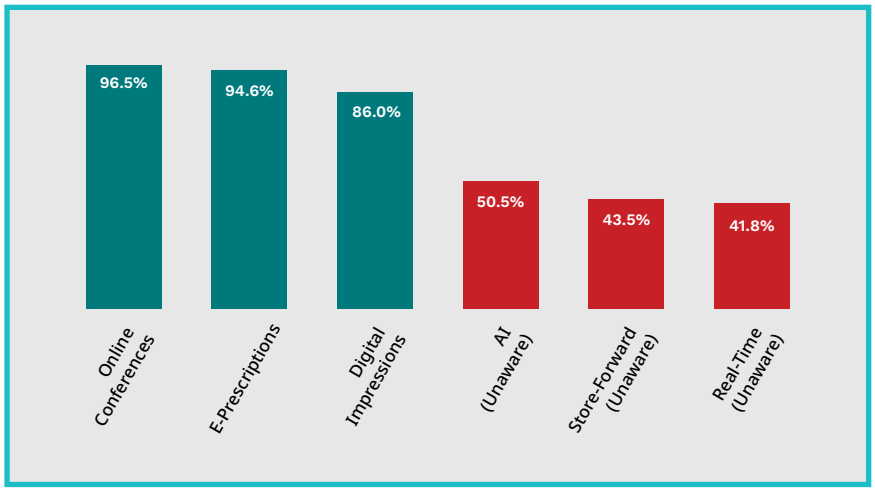
Study Samples

Our research intends to evaluate Hungarian dentists' knowledge and inclination for teledentistry. Furthermore, by recognizing and charting the current gaps in knowledge, we can better focus our educational efforts on the ways that teledentistry can advance dentistry (Németh et al., 2023).

A total of 6,894 dentists were contacted, from which 171 (0,025%) dentists completed the survey. Out of 171 dentists, 40 men and 131 women participated, with an age distribution of 73 below 40 years old (42.7%) and 98 older than 40 years (57.3%). Most of the participants (99.4%) were working primarily in Hungary. 35.5% work in the capital city (Budapest), and 64.5% work in the countryside. Regarding hours spent in patient care, most participants (50.7%) worked 30 or fewer hours weekly. 13.8% treated patients between 50 and 149 km, and 2.9% treated patients with a distance >150 km. The best-known digital technologies are online conferences (96.5%), e-prescriptions (94.6%), and digital impressions (86.0%). Unawareness is the highest in the field of artificial intelligence in dentistry (50.5%), store-forward solutions (43.5%), and real-time solutions (41.8%).

Main Category	Subcategory	n (per capita)	Value (%)
Survey Completion	Total contacted	6894	-
	Total completed	171	0.03%
Gender Distribution	Male	40	23.40%
	Female	131	76.60%
Age Distribution	Under 40 Years	73	42.70%
	Over 40 Years	98	57.30%
Location Distribution	Primarily in Hungary	170	99.40%
	In Capital City (Budapest)	61	35.50%
	In Countryside	110	64.50%
Hours Spent in Patient Care	≤ 30 Hours Weekly	87	50.70%
Distance of dental office and patients	Distance 50-149 km	24	13.80%
	Distance > 150 km	5	2.90%
Awareness of Digital Technologies	Online Conferences	165	96.50%
	E-Prescriptions	162	94.60%
	Digital Impressions	147	86.00%
	AI in Dentistry	86	50.50%
	Store-Forward Solutions	74	43.50%
	Real-Time Solutions	71	41.80%





Main Results

The Scope and Impact of Digital Dentistry

Digital dentistry encompasses a broad range of technologies and systems designed to enhance dental care (Bhambal et al., 2010). When we talk about digital dentistry, even for the majority of healthcare professionals, the term is still associated with digital workflow tools such as intraoral scanners, CAD/CAM technology, 3D printing, CBCT, and Digital Smile Design (DSD). In truth, digital workflow tools are just one aspect of digital dentistry. The Digital Patient-Doctor Communication Systems (DCS) toolbox and the opportunities given by Dental Digital Sources (DDS) may be less well-known at the moment, but they are equally important. In our research, we have covered all these aspects of digital dentistry.

In light of the results, the current situation of teledentistry in Hungary and the attitude of the dental society towards this rapidly developing digital world are clearly outlined. We can pinpoint the areas that require further development and knowledge enhancement, for both practitioners and patients and investigate the underlying causes of some of the trends.

Digital communication systems (DCS) such as store-forward and real-time solutions, smartphone applications, and e-Health Care Cloud Hosting were investigated for their potential use in dentistry. DCS play a crucial role in the development and implementation of teledentistry, offering inventive solutions that improve patient care and accessibility (Daniel & Kumar, 2014). These systems leverage various technologies to facilitate remote consultations, diagnoses, and treatment planning, significantly transforming traditional dental care delivery (Uhrin et al., 2023).

According to the results, 91.7% of respondents said they would like to utilize these tools in the future. This shows that dentists value the benefits of teledentistry, including reduced number of in-person visits and improved patient care quality. However, one in every eight dentists does not use any of the digital communication tools mentioned above. This highlights a significant disconnection between the intention and actual usage of DCS (Digital Content Services) tools among practitioners. Despite the clear motivation and ambition to utilize these digital tools, there appears to be a mismatch between the aspirations and the reality of their implementation in practice. It would be important to explore the underlying reasons for this discrepancy in order to find a solution (Estai et al., 2016).

Generational Trends in Digital Communication System Usage Among Dentists

Younger dentists are more knowledgeable about digital communication systems (DCS) than older generations, however, there is no apparent association between age and use. Dentists currently working span several generational cohorts, each with distinct characteristics and habits regarding the use of DCS.

Generation Z (GenZ, age 25-29) have grown up in the world of the internet and digital technology, and are highly proficient and comfortable with DCS, including smartphone apps, telehealth platforms, and cloud-based solutions. Millennials (age 33-40) experienced the rise of the internet and mobile technology during their formative years, and generally value the efficiency and convenience provided by digital tools, proactively seeking out and utilizing new technologies. Generation X (age 45-54) witnessed the transition from analog to digital technology in their early professional lives, and are still considered competent in using essential DCS but may be selective about adopting new systems, needing more time to adapt compared to younger colleagues. Baby Boomers (age 55-70) started their careers in a predominantly analogue world and gradually adapted to digital tools, with their DCS usage varying

widely - some are enthusiastic about DCS and actively integrate them, while others may use them minimally, relying on traditional methods (Volkom et al., 2014).

While our research clearly reflected these generational differences in the everyday use of digital technology and DCS-related knowledge, it is an interesting contrast that these generational differences vanish when it comes to actual DCS usage in dental practice. There is no strong correlation between age and the actual use of DCS, indicating that individual preferences and practice needs play significant roles in technology adoption across all age groups. On the other hand, gender does not significantly impact awareness or use of communication technologies.

Unlock the Power of Digital Tools – The Role and Challenges of Dental Digital Sources in Patient Care

We inquired with dentists about dental digital sources (DDS), including webpages, social media, and smartphone applications. Over 75% of the interviewed dentists have previously recommended DDS to their patients. More often than not, they propose dental applications but they do not utilize them. This implies that they either (a) recommend applications without fully understanding their content or (b) promote applications without sufficient professional content control.

Enhancing dental professionals' understanding of teledental applications may result in better oral health (Nutalapati et al., 2011). Nowadays, increasing human resource shortages and significant regional disparities in the availability of professionals pose a difficult challenge to the provision of dental care, and this is particularly striking in the field of public dental health. Turning to digitalization could be an obvious, easily accessible, and cost-effective solution to workforce challenges. It is well-established that dental apps, selected under proper professional supervision and carefully taught to the patient, are an effective tool for health education, prevention, instruction, and motivation (American Dental Association, 2020). However, it is not necessarily the right idea to leave this task to dentists. Dental hygienists can perfectly integrate this responsibility into their competencies, effectively incorporating these digital tools into their preventive activities (Bersell, 2017).

The Role of Digital Dentistry in Enhancing Preventive Care

In an era of unprecedented specialization in dentistry, we are losing sight of the mission that should be the real priority: prevention. The World Health Organization (WHO) recognizes oral health as an integral part of general health and well-being. The latest WHO Action Plan on Oral Health, launched in 2022, emphasizes the importance of integrating oral health as a non-communicable disease (NCD) into broader health policies and programs to achieve universal health coverage and address the global burden of oral diseases.

The Action Plan underscores the necessity of integrating oral health services with primary health care (PHC). This approach ensures that oral health is not treated in isolation but as a fundamental component of overall health systems. Furthermore, it aims to enhance the accessibility and quality of oral health services. A significant focus is on preventive measures and health promotion activities to reduce the incidence of oral diseases.

Digital dentistry plays a crucial role in this preventive strategy by revolutionizing everyday operations and capabilities of dental practices. It encompasses various technologies, including electronic health records, digital radiography, intraoral imaging, and computer-aided treatment planning. These digital tools enhance the predictability, efficiency, and overall patient experience in dental care, facilitating more effective preventive measures and early interventions.

The latest WHO Oral Health Platform recognizes oral diseases as significant NCDs due to their prevalence and impact on overall health. This classification highlights the shared risk factors between oral diseases and other NCDs, such as poor diet, tobacco use, and alcohol consumption. The platform advocates for integrating oral health into broader health policies and NCD prevention strategies, emphasizing the importance of universal health coverage, prevention, and early intervention.

By addressing oral health within the context of NCDs and integrating it into PHC, the WHO aims to reduce the global burden of oral diseases and improve overall health outcomes. These global endeavours highlight the necessity for dental professionals to acknowledge once again the significance of a preventive strategy and to recognize that they are treating patients as a whole, not just teeth or mucous membranes.

In the age of digitalization, the lack of workforce or time resources is not an excuse for not implementing preventive strategies, as the tools already exist and must be utilized. Digital dentistry provides the infrastructure needed for seamless data transfer and integration within existing health systems, ensuring that preventive care is both accessible and effective.

A professional overview must also be established to oversee the suggested applications, guaranteeing that they are appropriate for individualized prevention and raising patients' oral health literacy (Ferguson& Frydman, 2004) (Masters et al., 2010).

Digital Workflows and Infrastructure

Respondents expressed serious concern about the inadequate infrastructure in DCS. Additional comments from respondents highlight this difficulty, even though many are eager to devote at least 20% of their working time to improving their knowledge of teledentistry. Recent survey results emphasize the significance of continuous learning, particularly graduate and postgraduate education, in teledentistry tools (Chen et al., 2003).

Digital workflows are being prioritized over doctor-patient interactions in Hungary's dental industry's digitalization. Foreign articles, on the other hand, focus primarily on the possibilities of telecommunication and telediagnosis in this context. Our results are aligned with this trend: although 89.1% of dentists are aware of digital workflows (3D planning, 3D printing, 3D surgical guides), 71% have yet to implement it. 77.8% of respondents said they would like to try at least one of these technologies in the future. The two most popular dental specialties are radiology and prosthodontics. Prosthodontic preferences are met by the digital workflow, especially when it comes to digital impression-taking and the digitalization of laboratory work phases. There is a considerable reduction in awareness of digital workflow tools among dentists aged 55 and 70 compared to younger ones. Women tend to utilize fewer digital workflow tools than males. A total of 47.9% (n=83) of dentists reported that their workplace infrastructure is not suitable for teledentistry.

The Digital Dental Index Shows Younger Dentists are More Likely to Use Digital Dentistry in the Future

A digital dental index variable was created and built with a linear regression model as a dependent variable. Explanatory variables are advantages, disadvantages, what would be necessary, experienced needs from the patients, and age. The digital dental index is 14.24 (SD = 5.5), with 81.2% receiving at least 10. The analysis of socio-demographic variables and their impacts on the digital dental index shows the following: gender has no significant association, but age has a considerable impact, although the relationship is not linear. The 30-34-year-old group has the greatest digital dental index value (mean=16.6; M=15.9), while the 55-59 age group has the lowest (mean=11.6; M=11.9).

The digital dental index varies by workplace type, with universities (mean=16.2; M=18) and national institutions (mean=16.7; M=16) having the highest values, followed by private healthcare providers (mean=15.2; M=14) and private companies (mean=15.1; M=16). Public dental offices have the lowest digital dental index (mean = 11.3; M = 11). The value of the digital dental index decreases steadily from capital (mean=16.8; M=17) to villages (mean=10.8; M=9). It is essential to underline that the degree of patient demand they observe regarding the use of digital devices is the primary factor influencing the index's value. According to the digital dental index, dentists intend to use teledentistry tools in their routine procedures. Notably, the score indicates that age has a negative impact, implying that younger people are more likely to use digital dentistry solutions in the future.

Conclusions

Teledentistry holds immense potential in revolutionizing patient-dentist interaction and expanding access to dental care, particularly in underserved areas (American Telemedicine Association, 2023). However, its widespread adoption faces several challenges, including technological barriers, diagnostic limitations, legal and regulatory complexities, and patient acceptance. To mitigate these challenges and make teledentistry more universally acceptable, several strategies can be employed:

- Investing in infrastructure to improve internet connectivity and provide devices to patients
- Integrating teledentistry into existing practice workflows and ensuring seamless interoperability with electronic health records and practice management software
- Implementing robust cybersecurity measures to safeguard patient information and comply with data privacy regulations
- Providing specialized training to dental professionals on utilizing telehealth technologies and communicating effectively with patients remotely

Ultimately, the successful integration of teledentistry into the fabric of dental practice requires a multifaceted approach. It involves collaboration between policymakers, dental professionals, and patients to overcome technological, regulatory, and educational barriers. By embracing digital solutions and prioritizing prevention, the dental community can shape a future where quality oral healthcare is accessible to all.

And remember - quoting Henry Percy Pickerill: „If, during the past one hundred years, half as much time, money, and brain power had been spent in evolving means for the prevention of dental caries, as has been spent in the perfecting of ways and means for replacing artificially tissue lost by disease, there can be no doubt that the present condition of affairs would not have come about." This is a serious message that is still valid in the age of digitalization. Every day, 8 million teeth are born into the world. Every dental professional has a duty to save as many of them as possible. At the end of the day, this must be our common ultimate goal.

The chapter is based on the following article:

Németh, O., Uhrin, E., Girasek, E., Boros, J., & Győrffy, Z. (2023). The impact of digital healthcare and teledentistry on dentistry in the 21st century: A survey of Hungarian dentists. BMC Oral Health, 23(1). https://doi.org/10.1186/s12903-023-03770-w

References

Németh, O. (2021a). A telemedicina alapkérdései. In Zsuzsa Győrffy (Ed.), Digitális egészség a mindennapi gyakorlatban. Gyógyító Nőkért Alapítvány. Budapest. 69-84.

Smith, A. C., Thomas, E., Snoswell, C. L., Haydon, H., Mehrotra, A., Clemensen, J., & Caffery, L. J. (2020). Telehealth for global emergencies: Implications for coronavirus disease 2019 (COVID-19). Journal of Telemedicine and Telecare, 26(5), 309-313. https://doi.org/10.1177/1357633x20916567

Ghai, S. (2020). Teledentistry during COVID-19 pandemic. Diabetes & Metabolic Syndrome: Clinical Research & Reviews, 14(5), 933-935. https://doi.org/10.1016/j.dsx.2020.06.029

Chen, S. F., & Feng, J. W. (2005). Telemedicine in China: A review of the implementation and development during the SARS epidemic. Telemedicine and e-Health, 11(4), 452-459. doi:10.1089/tmj.2005.11.452.

Mariño, R., & Ghanim, A. (2013). Teledentistry: A systematic review of the literature. Journal of Telemedicine and Telecare, 19(4), 179-183. https://doi.org/10.1177/1357633x13479704

American Telemedicine Association. (2014). ATA emergency and disaster response: A special interest group action plan. Telemedicine and e-Health, 20(7), 633-639. doi:10.1089/tmj.2014.9902.

NATO Centre of Excellence for Military Medicine. (2011). Telemedicine systems in NATO multinational operations: Scenarios and implementation. NATO Medical Bulletin, 67, 20-27. Retrieved from https://www.coemed.org.

Hungarian Government. (2020). Government decree on telemedicine services during the COVID-19 pandemic. Retrieved from https://www.kormany.hu/en/ministry-of-health

National Healthcare Service Center. (2020). Implementation and promotion of telemedicine in Hungary during COVID-19. EESZT Report, 34-38. Retrieved from https://www.eeszt.gov.hu.

Győrffy, Z., Békási, S., Szathmári-Mészáros, N., & Németh, O. (2020). A telemedicina lehetőségei a covid–19-pandémia kapcsán a nemzetközi es a magyarországi tapasztalatok es ajánlások tükrében. Orvosi Hetilap, 161(24), 983-992. https://doi.org/10.1556/650.2020.31873

Greenhalgh, T., & Wherton, J. (2020). Telemedicine in health care: Lessons from the COVID-19 pandemic. The Lancet Digital Health, 2(8), e388-e394. doi:10.1016/S2589-7500(20)30190-2.

Németh, O. (2021b). Az Online vizit. In: Győrffy, Zsuzsa (Ed.) Digitális egészség a mindennapi gyakorlatban. Gyógyító Nőkért Alapítvány. Budapest. 85-100.

Nemeth, O., Orsos, M., Simon, F., & Gaal, P. (2021). An experience of public dental care during the COVID-19 pandemic: Reflection and analysis. International Journal of Environmental Research and Public Health, 18(4), 1915. https://doi.org/10.3390/ijerph18041915

Estai, M., Kanagasingam, Y., Tennant, M., & Bunt, S. (2018). A systematic review of the research evidence for the benefits of teledentistry. Journal of Telemedicine and Telecare, 24(3), 147-156. https://doi.org/10.1177/1357633x16689433

Németh, O., Uhrin, E., Girasek, E., Boros, J., & Győrffy, Z. (2023). The impact of digital healthcare and teledentistry on dentistry in the 21st century: A survey of Hungarian dentists. BMC Oral Health, 23(1). https://doi.org/10.1186/s12903-023-03770-w

Bhambal, A., Saxena, S., & Balsaraf, S. V. (2010). Teledentistry: Potentials unexplored. Journal of International Oral Health, 2(3), 1-6. https://www.ispcd.org/userfiles/rishabh/2-_Teledentistry.pdf

Daniel, S. J., & Kumar, S. (2014). Teledentistry: A key component in access to care. Journal of Evidence Based Dental Practice, 14, 201-208. https://doi.org/10.1016/j.jebdp.2014.02.008

Uhrin, E., Domokos, Z., Czumbel, L. M., Kói, T., Hegyi, P., Hermann, P., Borbély, J., Cavalcante, B. G., & Németh, O. (2023). Teledentistry: A future solution in the diagnosis of oral lesions: Diagnostic meta-analysis and systematic review. Telemedicine and e-Health, 29(11), 1591-1600. https://doi.org/10.1089/tmj.2022.0426

Estai, M., Kruger, E., Tennant, M., Bunt, S., & Kanagasingam, Y. (2016). Challenges in the uptake of telemedicine in dentistry. Rural and Remote Health. https://doi.org/10.22605/rrh3915

Volkom, M. V., Stapley, J. C., & Amaturo, V. (2014). Revisiting the Digital Divide: Generational Differences in Technology Use in Everyday Life. North American Journal of Psychology, 16(3), 557-574.

Nutalapati, R., Jampani, N., Dontula, B. S., & Boyapati, R. (2011). Applications of teledentistry: A literature review and update. Journal of International Society of Preventive and Community Dentistry, 1(2), 37. https://doi.org/10.4103/2231-0762.97695

American Dental Association. (2020). ADA policy on Teledentistry. Retrieved July 5, 2024, from https://www.ada.org/about/governance/current-policies/ada-policy-on-teledentistry

Bersell, C. H. (2017). A national crisis and call for reform. American Dental Hygienists' Association, 91(1), 6-14. https://jdh.adha.org/content/91/1/6

Ferguson, T., & Frydman, G. (2004). The first generation of E-patiEnts. BMJ, 328(7449), 1148-1149. https://doi.org/10.1136/bmj.328.7449.1148

Masters, K., Ng'ambi, D., & Todd, G. (2010). I found it on the internet preparing for the e-patient in Oman. Sultan Quaboos University Medical Journal, 10(2):169-79. http://hdl.handle.net/11427/8857

Chen, J., Hobdell, M. H., Dunn, K., Johnson, K. A., & Zhang, J. (2003). Teledentistry and its use in dental education. The Journal of the American Dental Association, 134(3), 342-346. https://doi.org/10.14219/jada.archive.2003.0164

Telehealth: defining 21st century care. (2023, August 16). American Telemedicine Association. Retrieved July 5, 2024, from https://www.americantelemed.org/resource/why-telemedicine/

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Taking a Closer Look at Physicians in the Context of Digital Health: Experiences from a Qualitative Study

Key Messages

- With the help of in-depth interviews, we can have a more detailed picture about the attitudes of medical doctors toward digital health.
- Based on the results of the qualitative study, most respondents emphasize the advantages of digital health in their professional lives.
- However, some disadvantages were also noted, with work-life balance being a significant concern.
- The blurring of boundaries can lead to doctors being constantly available, which has both positive and negative aspects.
- For the majority of physicians, setting and maintaining boundaries is a priority.
- To address work-life balance issues, both active self-reflection and institutional support are essential.

Introduction

International experience suggests that digitalisation has changed the medical profession in many aspect, including workload and pace, the field and nature of work, work community communication and interaction, and information flow and security (Kaihlanen et al, 2023). Digitalisation offers many benefits, but it also has potential drawbacks. Digital technologies, like teleconsultations can allow for high levels of flexibility in terms of deciding working hours and choosing where to work, can reduce workload, but at the same time, technology can also present frequent challenges and ensuring patient safety may also pose greater difficulties (Fernemark et al 2020).

Additional challenges may include that some patient groups face difficulties in accessing and using technologies due to socio-cultural factors or technological and linguistic problems, or the lack of caregivers (Antonacci et al, 2023). Physicians' attitudes toward digital technology can depend on the perception of their professional identity and their sense of control over the implementation of digital technologies, as well as on organizational support (Golan Cohen et al, 2023). To enhance the use of digital tools, it is also essential to establish proper regulations on data governance (see the chapter about digital health policy), develop evidence-based guidelines, promote the integration of tools and processes, and provide patient-centered training for clinicians (Antonacci et al, 2023).

As we could see from the results of the medical survey, knowledge, use and the intention of future use of digital health technologies are widespread among Hungarian medical doctors (Girasek et al, 2023).

In addition to quantitative physician research, we also considered it important to gain a deeper understanding of the knowledge, skills, attitudes, and opportunities of Hungarian physicians in relation to digital health, so we decided to complement the study with qualitative interviews with doctors.

Study Sample

62 semi-structured interviews were conducted by trained interviewers with several years of experience in fieldwork between October 2021 and June 2022. The study methodology is described in detail in the methodology chapter.

Demographic Profile"		**N**
Sex	*Male*	32
	Female	30
Age group	*–39*	23
	45–59	26
	60+	9
	Unknown	4
Type of settlement	*Capital*	28
	County seat	10
	Other town	13
	Abroad	1
Type of medical job	*Primary Care*	28
	Medical specialist	29
	Resident	3
	Dentist	2
Total		**62**

The interview guide was based on the following topics: work and career choice, technological changes in the medical field over the past decades, the different types of digital health devices and services they use/know, how the doctor-patient relationship changed since the start of their career, perceived future role of digital health.

Results

During the qualitative research process using the inductive thematic approach, 5 researchers discussed and developed all themes and subthemes and clarified any discrepancies during the coding. Afterward, they evolved the final thematic map, which was laid down in mutual agreement. In the initial step of our analysis,

each interview was read by two participating researchers parallel, trying to identify patterns of themes independently. Despite the common interview guide, the diversity of interviews was noticeable.

The following topics emerged during the first phase:

- What kind of digital technologies do physicians use?
  - Telemedicine: what is meant by it, whether it is used, whether it would be retained after the COVID-19 pandemic?
  - What are the experiences with EESZT?
- Is there a difference in the use of digital health before, during, and after the COVID-19 pandemic?
- What are the intentions of physicians for future usage of digital technologies?
- What skills are needed for the digital transition?
- Is the attitude towards digital health generally positive or negative?
- Do ethical and data protection issues arise in everyday practice?
- Does digital health facilitate communication within the profession?
- What are the advantages/disadvantages of digital health from the medical and patient side?
- How has digital health affected the doctor-patient relationship and communication? Can digital health fully replace face-to-face doctor-patient encounters, or is it only a complementary solution?
- How do doctors feel about their patients searching for information on the internet?
- Are there any “digital losers”, on either the patient’s or the doctor’s side? Are there geographical or generational differences in digital health use?
- What are patients’ needs for digital health?
- How does technostress affect doctors’ lives?
- Can digital health contribute to or prevent physicians’ burnout?
- How does digital health affect health professionals’ work-life balance?

Of the issues raised, the analysis focused on the topic of physicians’ work-life balance. For that purpose, we used 31 out of the 62 interviews that were related to the theme of work-life balance in connection to digital health solutions.

The selected topic was explored through the analysis of the following 5 themes:

1. Use of digital communication tools
2. Impact of digital tools on everyday work
3. Work-life balance
4. Setting and maintaining work-life boundaries
5. Potential solutions

The themes and subthemes are indicated in the following figure:

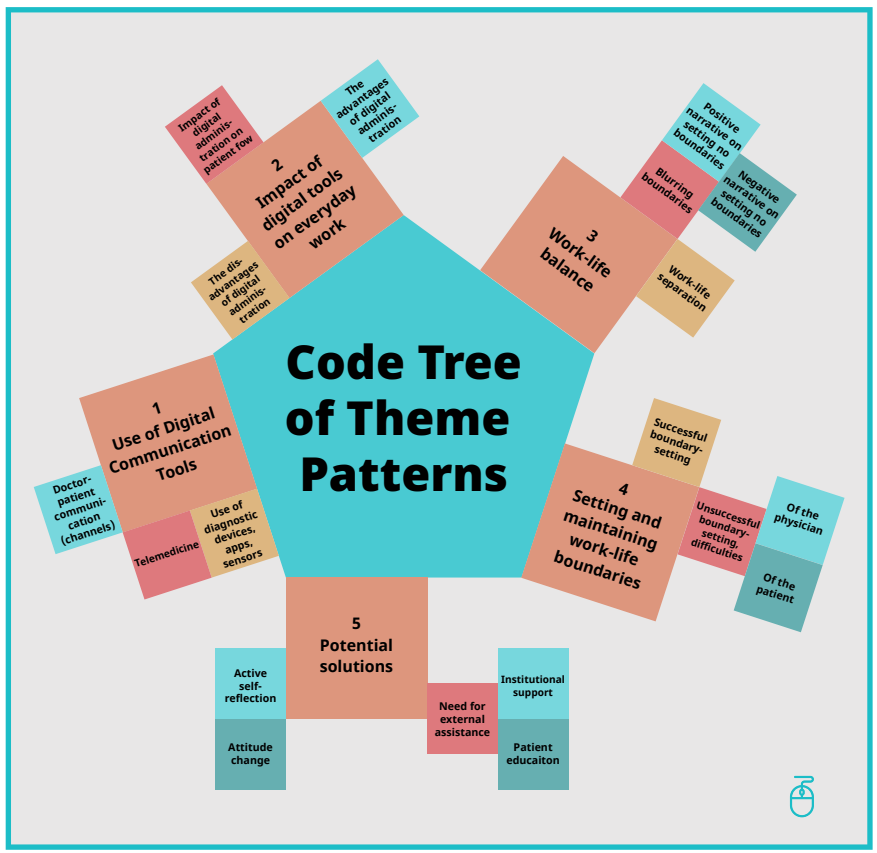

Figure 1: Code tree of theme patterns for the analysis of physicians’ interviews about digital health

Use of digital communication tools

Within this theme, 3 sub-themes have been identified: channels of doctor-patient communication, the use of telemedicine options, and the use of digital health devices.

Doctor-patient communication channels include phone lines (except for those specializations where direct communication is not part of the workflow), email (all respondents), and in some cases an own information and/or education platform. In general, primary care physicians use more channels for communication purposes than physicians do in specialized care, in accordance with the results of our quantitative medical research.

As for telemedicine, during the COVID-19 pandemic, all interviewees had phone visits, used e-prescriptions, transferred medical records online, and engaged with online scheduling systems. However, after the epidemic, telemedicine solutions have again taken a step back, and personal visits have become once again the dominant approach.

In case of the use of diagnostic devices, applications, and sensors, we can observe some generational differences. The most popular device that was mentioned was the Transtelephonic ECG. Besides this, some other tools were also reported but at a much lower frequency.

Impact of digital tools on everyday work

Three subthemes emerged when we examined the topic of using digital tools and their administrative impact on everyday work: the advantages and disadvantages of digital administration, and the impact of digital administration on patient flow.

Respondents highlighted several advantages of digital administration. They noted that e-prescriptions eliminate the need for physical patient-doctor meetings and that records from doctors in charge are readily accessible. Additionally, the ability to access medical records remotely enhances virtual mobility, allowing hospitals to assist one another more effectively.

On the other hand, email communication has become a common expectation for patients, which significantly increases the workload of doctors. The following example illustrates this:

> *"Patients are demanding, they want you to email them everything immediately. But they don't think that it's extra work for you to e-mail it, but it's difficult to communicate with patients in this way."*

In some cases, doctors complain that they have to double up on administration because, in addition to digital, they also have to do it the traditional (paper-based) way. It is also possible that previously digital administration requires more complex steps instead of the simple old way.

The impact of digital administration on patient flow proved to be somewhat controversial due to the specific timing. In theory, most interviewees admitted that DH could contribute to the reduction of workload as the online scheduling system had made the day-to-day running of the practice much more coordinated and predictable, but the epidemic has led to a significant increase in email activity.

Work-life balance

The theme of work-life balance was divided into two subthemes: blurring boundaries and work-life separation.

Blurring boundaries can lead to doctors being constantly available, frequently communicating with patients (via email, scheduling, etc.), and having no clear distinction between working hours and personal time. This situation can have both positive and negative implications for doctors.

Many respondents stated their positive attitude to their strong sense of vocation, empathy for patients, and commitment to reliability. Some noted that their sense of responsibility towards their patients often outweighs their own health challenges, so they stayed available to patients through home-based applications and programs even if they faced their own illnesses.

However, many physicians view the blurring of work and private life as a burden. Several interviewees reported an unmanageable workload and constant pressure to excel both professionally and personally. Many struggle to disconnect from work due to the nature of therapeutic responsibilities, with around half finding it difficult to relax and stop ruminating after hours.

"I was working day and night, weekends all the time. And in the meantime, I had to take care of my family, keep the family together, make sure everyone was happy."

On the other hand, work-life separation was not a problem in some cases, either because of the nature of the work (specialisation) or because of the lack of appropriate technical equipment (more so in the case of older doctors, but this was rare).

"From a personal level, I don't see it as a significant influencing factor, certainly because I'm doing a very specific job, and you can't do that from home or anything like that, so it doesn't affect it in that way."

Setting and maintaining work-life boundaries

The efforts to achieve work-life separation and balance appeared in every single interview. In this theme, two subthemes emerged: successful and unsuccessful boundary-setting.

In case of successful boundary setting, appropriate time management was crucial. Some physicians limit their availability for online communication, emails, and phone calls by establishing specific timeframes for these services.

"But we have a pretty good system in place, I think, and the patients understand that I don't want them to constantly be in contact with me."

The separation between private and official use of social media is also useful in this respect.

"A lot of times I find that a mum will tag me as a friend on Facebook, and I don't intentionally confirm them because they are not my friends, not my acquaintances."

Behind unsuccessful boundary-setting were problems on the part of the doctor and perceived difficulties on the part of the patients.

Doctors often struggled with setting boundaries and faced challenges largely due to their own high expectations. A notable issue is that many of them fail to establish clear personal limits.

However, it is also very common for patients not to respect doctors' privacy: half of the respondents had the sense that patients expect them to be available all the time.

"Patients can be very abusive if they have your phone number".

Potential solutions

Most doctors are trying to find solutions to the challenges of work-life balance. Patterns of coping can be divided into two groups: active self-reflection and the need for external assistance.

In case of active self-reflection, we can speak about the conscious use of digital tools, or setting the limits of an online presence. Physicians reported several good practices, for example defining timeframes for e-mail communication, or for social media sites, separating official and private pages; and rejecting requests and messages on private pages.

"This is, of course, all on the practice's site, I don't accept friend requests from anyone on my own profile, I don't reply because that's my private business."

The alternative approach is to embrace the blurring of boundaries as a way to alleviate pressure. By meeting patients' requests and expectations, doctors can find satisfaction in their profession due to their patients' satisfaction.

Beside individual solutions, the interviews highlighted a significant need for external support to address the challenges posed by digital tools. This includes both education (patients and doctors as well) and the adaptation of the institutional environment to the new circumstances. As regards the latter, there is a need for an institutional response to regulate the use of digital tools, for example, it should be agreed that answering e-mails is part of working time, and how digital communication can be handled in the event of replacement. Moreover, implementing dedicated digital assistants, or using the latest technological solutions could be an effective institutional strategy to reduce the burden on physicians, providing them with an opportunity to achieve a sustainable work-life balance.

Conclusions

Most of our research took place during COVID pandemic. This period has significantly accelerated the widespread adoption of digital health solutions – at the same time it was also a natural experiment to test a number of solutions that had not had time to develop naturally. Both doctors and patients had to cope with an unfamiliar life situation, with some having less success, others more.

Digital health solutions offer numerous benefits in terms of efficiency and patient care, but they also present significant challenges to maintaining a healthy work-life balance for physicians.

Among the advantages, we can mention the flexibility and convenience factor: using different digital tools allows managing schedules more efficiently. Additional benefits include that for some physicians, the ability to meet patient needs promptly through digital tools can be satisfying and professionally fulfilling.

However, digital tools often make physicians more accessible to patients outside traditional working hours. The constant availability can blur the lines between professional and personal time, leading to challenges in maintaining a clear work-life balance.

The results of our interviews draw attention to the importance of self-consciousness and communication in case of successful boundary setting for work-life balance. These skills are not self-evident. In the education and training of healthcare professionals, it would be important to write down clear rules, deepen the ways and possibilities of digital communication, and review the relationship with digital technology from time to time. In the next chapter, we examine how doctors of the next generation, today's medical students, are engaging with digital health solutions.

The chapter is based on the following article:

Győrffy Z, Radó N, Pölczman L, Sükösd A, Boros J. (2023) Creating work-life balance among physicians in the age of digitalization: the role of self-consciousness and communication – a qualitative study. *BMC Health Serv Res 23*, 1141 (2023). https://doi.org/10.1186/s12913-023-10101-w

References

Kaihlanen AM, Laukka E, Nadav J, Närvänen J, Saukkonen P, Koivisto J, Heponiemi T. The effects of digitalisation on health and social care work: a qualitative descriptive study of the perceptions of professionals and managers. BMC Health Serv Res. 2023 Jun 30;23(1):714. doi: 10.1186/s12913-023-09730-y. PMID: 37386423; PMCID: PMC10311778.

Fernemark H, Skagerström J, Seing I, Ericsson C, Nilsen P. Digital consultations in Swedish primary health care: a qualitative study of physicians' job control, demand and support. BMC Fam Pract. 2020 Nov 24;21(1):241. doi: 10.1186/s12875-020-01321-8. PMID: 33234111; PMCID: PMC7684852.

Antonacci G, Benevento E, Bonavitacola S, Cannavacciuolo L, Foglia E, Fusi G, Garagiola E, Ponsiglione C, Stefanini A. Healthcare professional and manager perceptions on drivers, benefits, and challenges of telemedicine: results from a cross-sectional survey in the Italian NHS. BMC Health Serv Res. 2023 Oct 18;23(1):1115. doi: 10.1186/s12913-023-10100-x. PMID: 37853448; PMCID: PMC10585875.

Golan Cohen A, Tal Y, Hersh D, Vinker S, Merzon E, Green I, Isrel A, Tuval A. The professional agenda and its effect on the implementation of telemedicine among primary care physicians: A qualitative study. J Telemed Telecare. 2023 Sep 6:1357633X231193787. doi: 10.1177/1357633X231193787. Epub ahead of print. PMID: 37670678.

Girasek E, Boros J, Döbrössy B, Győrffy Z. E-orvosok Magyarországon: Digitális egészséggel kapcsolatos tapasztalatok és vélemények a hazai orvosok körében [E-physicians in Hungary: Experiences and opinions related to digital health among Hungarian physicians]. Orv Hetil. 2023 Jan 29;164(4):132-139. Hungarian. doi: 10.1556/650.2023.32686. PMID: 36709435.

Braun V, Clarke V. Using thematic analysis in psychology. Qualitative Research in Psychology. 2006;3(2):77-101.

Zsuzsa Győrffy, András Wernigg

Knowledge and Attitudes Towards the Digitalization of Healthcare among Medical Students

Key Messages

- Responding students would use applications, online communication platforms and professional diagnostic tools in their subsequent work.
- They see many benefits of digitalization: better time management, better accessibility for patients and more efficient work.
- The majority of students think that the biggest disadvantage of the spread of digitalization is on the patients' side: 77.1 percent say patients have a limited understanding of digital devices and 69.4 percent are wary of the false and harmful self-education by patients.
- Overall, almost half of the students have a positive opinion about patient self- education: 46% say it is already useful if used with due care. According to another 21.6%, there are still more disadvantages today, but with the proliferation of digitalization and various smart devices in the future, it will be useful.
- According to students, easier access, financial support, and prior experience would inspire them to use modern technology in their later work.

Introduction

The digitalization of healthcare has changed the tasks, roles, and responsibilities of healthcare professionals (Abou Hashish 2024). As outlined in the concept of e-physicians (Meskó-Győrffy 2019) they are 'electronic' as they use digital technologies in their practice with ease. They are 'equipped' because they have digital health technologies at their disposal. They are 'enabled' by regulations and guidelines and 'empowered' by technologies that support their job. They are 'engaged' in as much as they have empathy to understand the feelings and views of patients, give them relevant feedback and involve them throughout the whole healing process. Finally, they are 'experts' in being familiar with the best and most reliable technologies and using them in their practice.

As we can see from these definitions, being an e-physician is more than just being digitally savvy. It is also an attitude and an orientation (Meskó -Győrffy 2019). The present medical student generation is already "digital native", using digital solutions actively in learning, daily life, and entertainment. That is why it is of principal importance to study how the doctors of the future think about the digitalization of healthcare and how they see their role in it. Hence in addition to the closed questions of our quantitative survey, the open-ended question: *How do you envision health in 2050* was also posed to the respondents. These predictive answers, in addition to the data quantification, provided a great amount of additional information about attitudes and beliefs projected for 2050.

Study Sample

This was an online questionnaire research of students of general medicine at all 4 Hungarian medical universities (SE, SZTE, DOTE, PTE) between April and June 2021 (n = 542). The questionnaire was made available on Neptun, the official online unified educational channel used by all universities in Hungary, and on a social media platform (Facebook). For some questions it was possible to involve an open control group: we compared the results of the student research with the appropriate age group of the population sample (18-29 years old, n = 270, from the population survey of 2021).

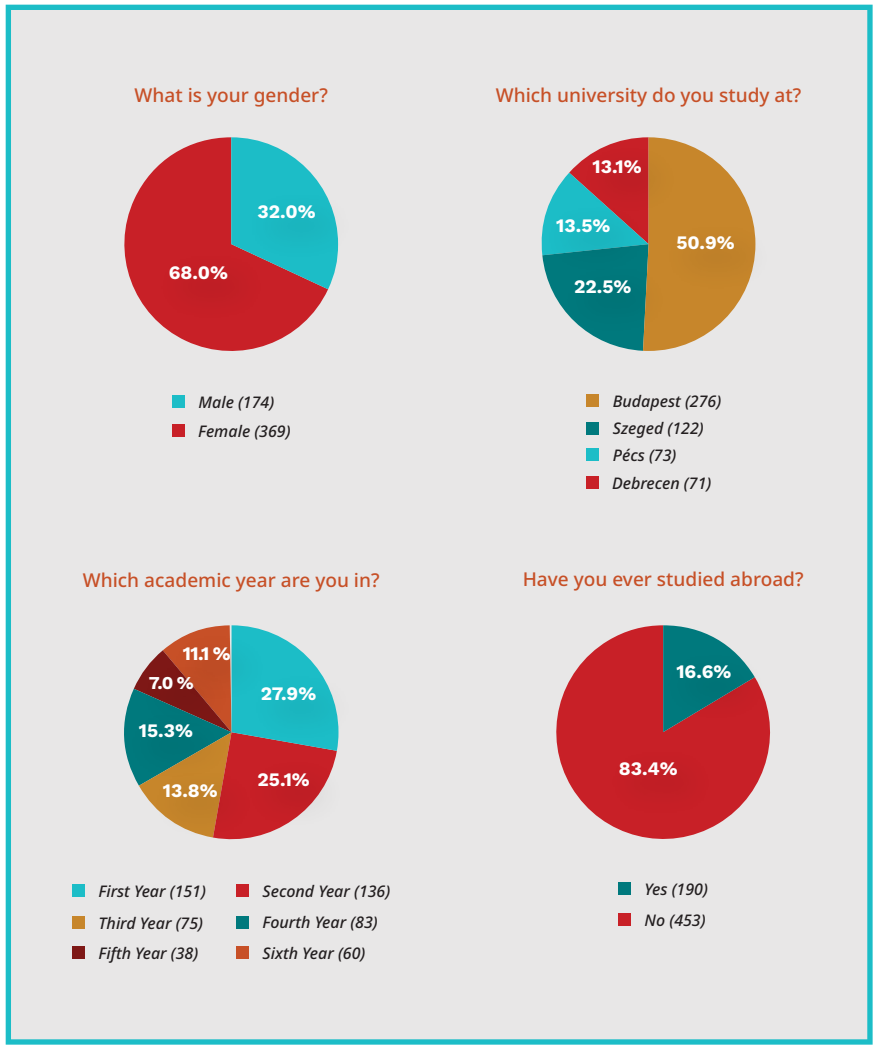

Figure 1: Demographic Profile (n=543 Faculty of Medicine, Average age: 21.85 years)

Main Results

Which Platform Do Students Use to Enquire about Questions of Health and Illness?

In our questionnaire, we were interested to know which internet platforms our students use to answer their health-related questions. The frequency of use of different websites (77% of the general population and 90% of students) ranked first in the survey. While 62% of medical students get their information from medical literature, this proportion is around 20% in the general population.

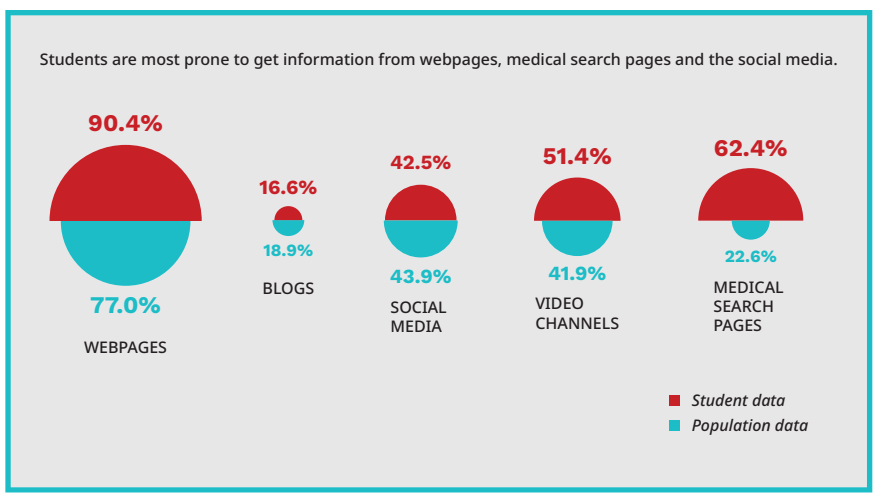

Figure 2: Which platforms do students use to enquire about questions Of health and illness?

The attitude of students towards patients who use the internet for health information was interesting. 48.3% of the respondents think that patients have adequate knowledge with due care. Additionally, they believe that self-education is highly beneficial and makes the work of professionals much easier. However, we also found that 26.2% found it particularly harmful and they think that it makes the work of doctors more difficult, so for the time being it is more of a disadvantage than an advantage.

Overall, students rate patients' self-education as fundamentally positive (70%). Our population survey has showed a similar result: according to patients, their doctors are basically receptive to their patients 'online information search:

- dislikes: 20.8%,
- moderate reception: 31.8%,
- good / very good reception: 31%
- don't know: 17%

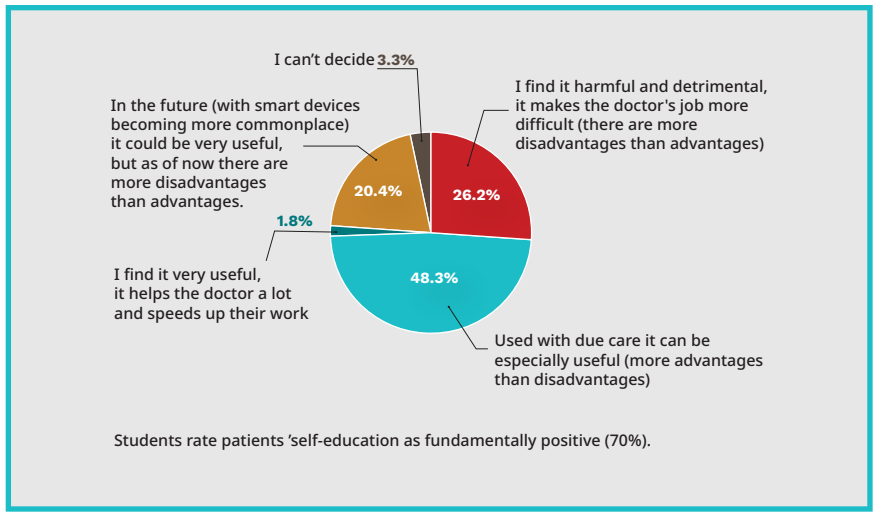

Figure 3: What is your opinion about patient self-education (patient self-diagnosis through online portals or later through smart devices)?

The Potential Benefits of Digitalization

Compared with our population survey, it can be concluded that time-saving is the biggest advantage for both sides (79% of respondents said that in the student survey and 89% in the general public). There was a quite remarkable difference in the proportion of responses to our two surveys in terms of the perceived decrease in the number of doctor-patient encounters as a benefit. While the population survey overwhelmingly indicated a clear positive response to the fact that a digitized healthcare system will require fewer face-to-face visits (85%), only 29.5% of students felt this way. The need for a personal doctor-patient encounter is of high importance for medical students. This may be due to

a sense of professional certainty or uncertainty: at the beginning of a medical career, the possibility of personal examination and contact increases the sense of certainty.

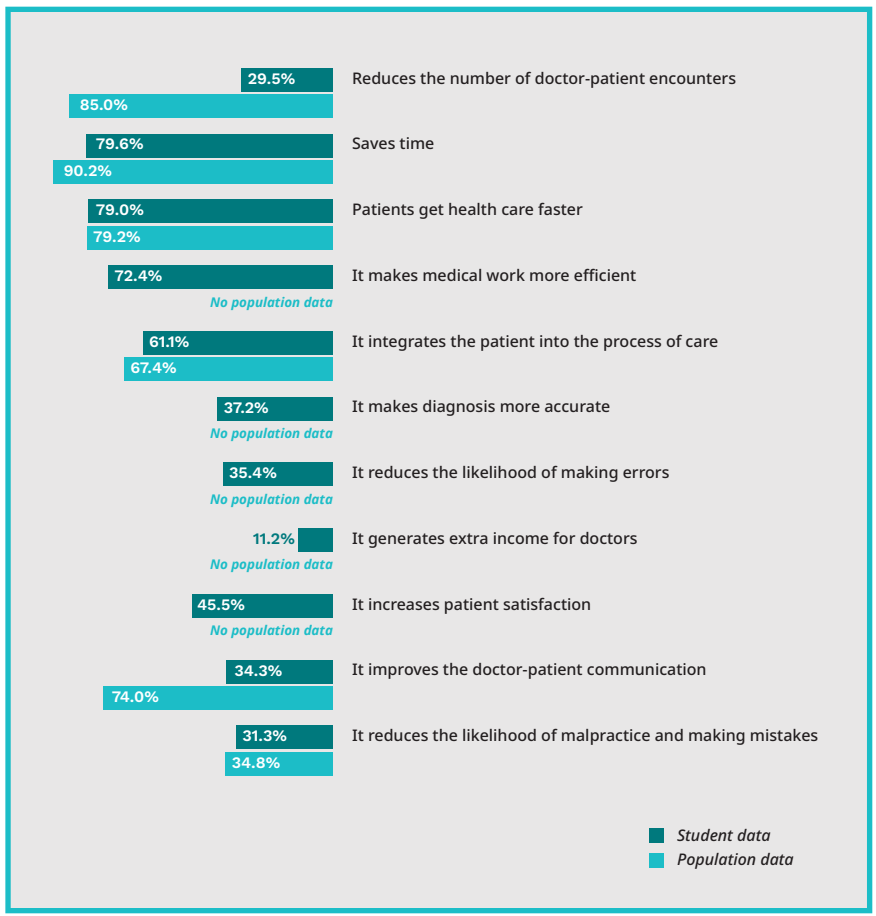

Figure 4: What are the possible benefits of digital health solutions?

What Are the Possible Disadvantages of Digital Health Solutions?

In our research, one of the most important findings from both the student and general population surveys was a significant disadvantage: due to inadequate delivery of data, results were often misinterpreted by both patients and professionals (69% of students, 72% of the general public). Additionally, the risk of faulty technology and the resulting risk of compromised data was highlighted by approximately 68% of the general public, compared to only 48% of students. This difference may be due to the different levels of education and information in the two samples.

Huge difference in the comparison of respondents to the two surveys was the perception of the possibility of burnout among professionals (45% of the general public respondents and only 23% of student respondents) and the risk of overdiagnosis (58% of the general public and 38% of students).

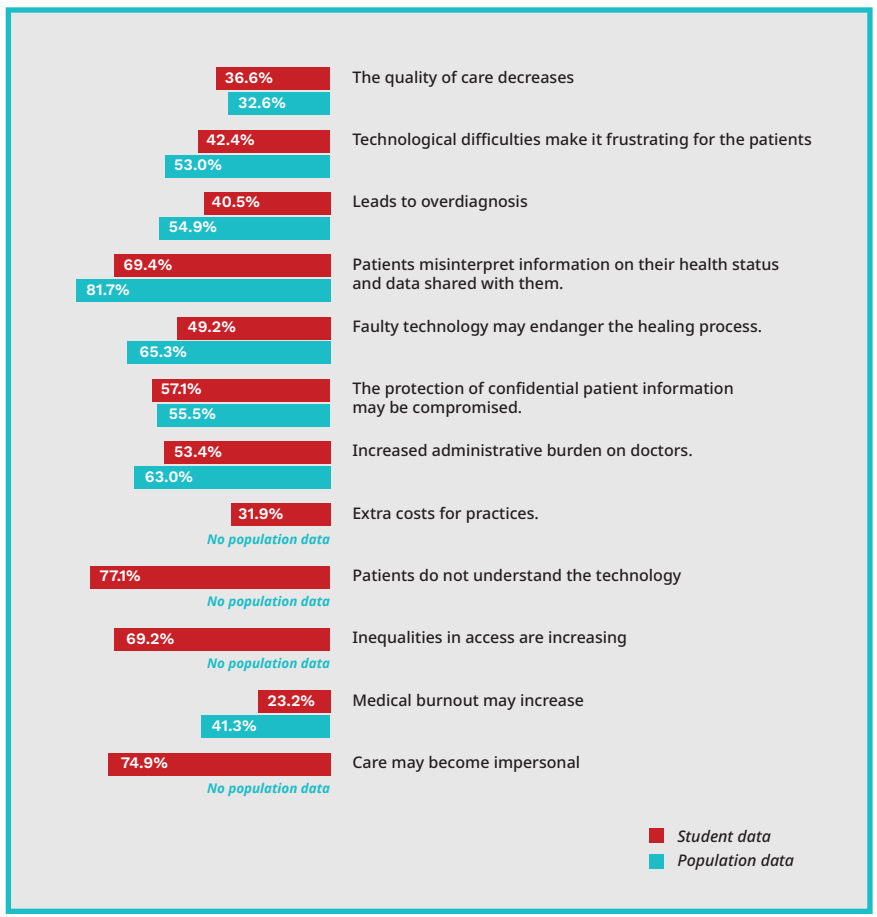

Figure 5: What are the possible disadvantages of digital health solutions?

What Types of Digital Tools Would Students Like to Use in their Future Work?

The results of our survey show that the vast majority of respondents are keen to use smartphone apps (87.4%), but many respondents thought that both diagnostic tools (74%) and online contact with patients (68.6%) would be important elements of their future work.

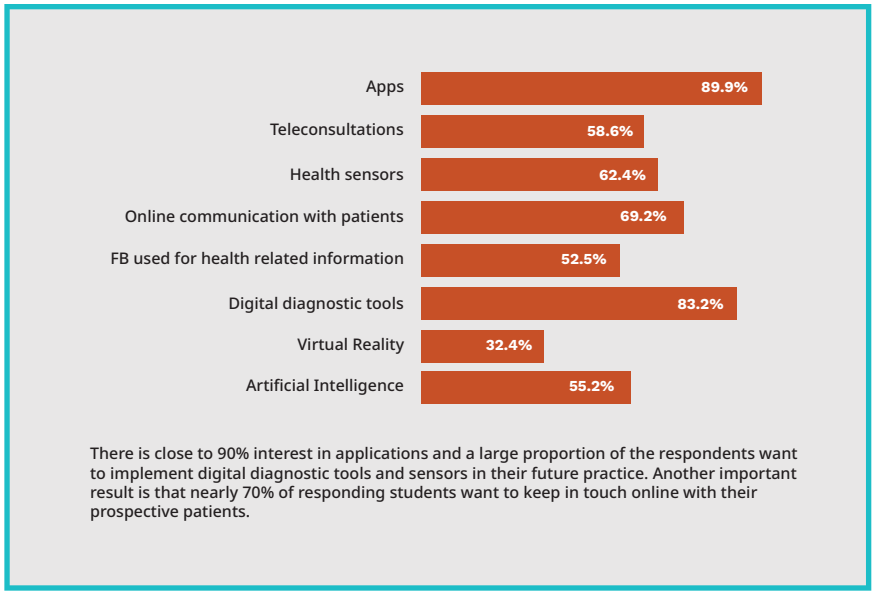

Figure 6: What types of digital tools would students like to use in their future work?

Incentives for Future Use

To ensure that health professionals of the future have the necessary conditions to use digital solutions, several drivers are needed. We were curious to know which elements our respondents consider essential to make digitalization an effective part of their future work. The most important factor identified by the students surveyed was the availability of technology (73.6%), more widespread/understood (66%) and cheaper (financial incentives 70.2%). For many, getting prior experience in the use of different technologies (69.4%), complemented by undergraduate (26.8%) and post-graduate training (30.2%).

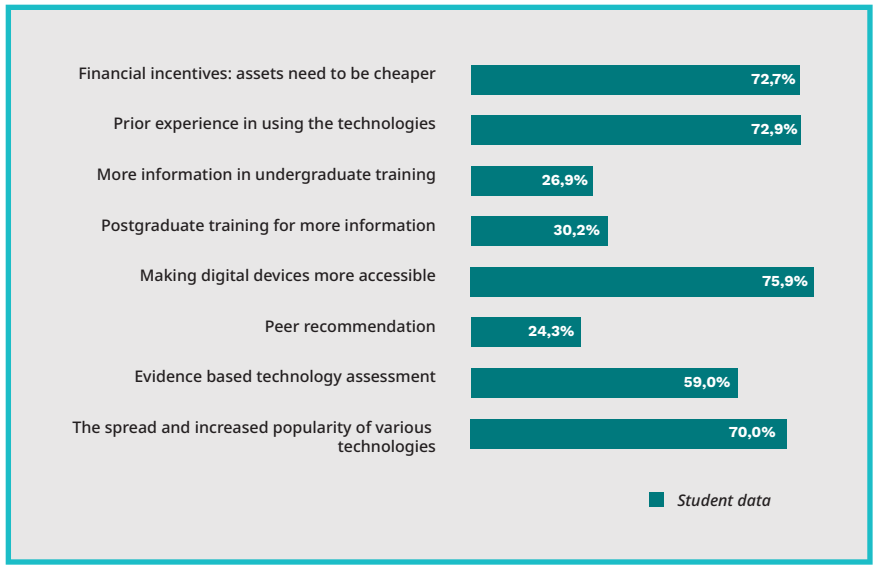

Figure 7: What is needed to facilitatte future use of digital health in their work?

The Role of Gender and Academic Year of Study

In the sample (n=543), men numbered 174, representing 32%, thus being in the minority compared to women (369). To understand the role of gender in this study, we used ANOVA on each quantitative variable, which were measured using a five-point Likert scale, with the respondent's gender. It turned out that men feel more positive (3.5) about the potential digitalization of education than female respondents (3.1734). The eta squared value is .018, indicating a medium effect size. Also, men have a more positive attitude towards digital health technologies (3.9) than women (3.6). The eta squared value is .041, indicating a medium effect size. Men feel significantly more prepared to work in a digitalized healthcare system (3.39) than women (2.89). The eta squared value is .091, indicating a strong effect size. On the other hand, there was no significant difference between the responses of men and women regarding how open they perceive doctors/healthcare workers/medical students in their environment are to technological advancements and digitalization.

Regarding academic year of study, most of the responses in the sample came from lower year students. Specifically, the first two years constitute 52.9% of the sample. The average year of study in the sample is 2.82.

Linear regression analyses were conducted to examine differences across years of study while controlling for gender and age variables.

1. The regression analysis was significant in the case of feelings about digitalization, with a B value of 0.143, a Beta value of 0.211, and an R-squared value of 0.044. This indicates that the higher the year of study of the respondent, the more positive were their feelings about a potential digitalization in education (increasing by 0.143 per year).
2. Another significant regression analysis regarding preparedness for digitalization showed a B value of 0.131, a Beta value of 0.212, and an R-squared value of 0.043. This suggests that the higher the year of study, the more prepared the respondents feel to work in a digitalized healthcare system (increasing by 0.016 per year).

Education: Preparing for the Future

68.6% of respondents are very or strongly in favour of the suggestion that a subject on digital health (compulsory/optional) should be introduced, while only 11.1% felt that this was not necessary. 87.5% of our students would like to hear about the modern, well-known tools and methods that are currently in use (compared to 39.8% of respondents who would prefer to learn about less common tools, methods, and technologies), and 55.3% indicated that they would prefer to learn about methods that have not yet been used as part of the introduction of such a subject.

Summary of the Quantitative Sample Results

The patient sample shows that the young age group does not necessarily require a personal doctor-patient relationship, and they believe that digital devices provide an opportunity for better doctor-patient communication. They are more afraid than medical students that the lack of technical knowledge or the use of inappropriate tools is a significant disadvantage. They fear that care will become impersonal and estimate the risk of burnout among doctors to be higher. They are more likely to use blogs, podcasts, and social media for gathering health information than their medical peers. And yet the non-medical population's use of medical search interfaces is much lower. Interestingly, they are less optimistic about the digitalization of health care although the rate of positive expectations is also above 40%.

How Do I Imagine Healthcare in 2050?

Opinions and feelings about digitalization were expressed in part in response to the questions presented above. However, we were also curious to know what the students' predictions for the future are concerning technological transformation, digitalization. The research used qualitative analytical elements and principles to obtain our results.

The question defining the vision was grouped in a thematic analysis in several stages. Then, general attitudes towards the future were examined based on the content of the respondents' answers, which resulted in five groups: those with a clearly positive vision, those with moderately positive expectations, those with neutral expectations (who in their answers assume that the health sector will remain in a similar state), and those with moderately negative expectations and with negative expectations. Words expressing positive and negative emotions (e.g. better and worse) played an important role in the formation of these groups, and the very frequent use of words and phrases expressing hope (e.g. hope, I hope), which could show intermediate emotions (hope being a way of expressing that the respondent does not have a clear vision of the future), was also used in the shading process. If these clear statements were not

included in the answer, or if the answer did not show a clear direction, it was placed in the neutral group. From the variables generated along this logic, a typology was created to show the general direction of medical students' vision of the future in 2050.

Expectations towards the future of healthcare and digitalization		**Frequency**	**Percentage**
General attitude	Positive	95	18%
	Negative	40	7%
	Neutral	164	30%
	Moderately positive	223	41%
	Moderately negative	21	4%

Table 1: Expectations towards the future of healthcare and digitalization

Expectations towards digitalization		Frequency	Percentage
General attitude	Positive	43	23%
	Negative	63	34%
	Neutral	65	35%
	Moderately positive	8	4%
	Moderately negative	8	4%

Table 2: Expectations towards digitalization

The general content of the vision of respondents who mentioned digitalization:

1) Positive responses:

This group's responses represent 23% of the sample and responses suggest that the future of healthcare will bring many changes, but healthcare will be much more modernised and digital. The impact of these technological developments will make healthcare much more efficient. Digital tools, apps and the use of artificial intelligence will become more widespread.

Several responses reflect the growing importance of disease prevention, which could, among other things, provide a solution to the overload in the health sector. Most of the responses in this group suggest that the importance of the doctor-patient relationship will continue to be highlighted and will not be fully replaced by digital solutions. Respondents also believe that the digitalization of healthcare can help a lot in administration and management of health data, which could have the effect of alleviating the workforce shortage in healthcare. Diagnostic and therapeutic techniques will be more advanced and more widely available, which will undoubtedly have a positive impact on healthcare, and artificial intelligence and algorithms will play a greater role in diagnosis and therapy. Digitalization will make it easier to track patients and manage health data.

Overall, the future of healthcare may be significantly transformed by digitalization and technological advances, but human relationships and doctor-patient interaction will remain important.

> *"I'm expecting the digitalization of hospitals, especially in the context of an AI system that continuously analyses patient data, doctor's treatments and learns from them, making recommendations that the doctor can accept or overrule at his or her discretion. At some point, it can even warn to avoid a medical error."*

2) Moderately positive responses:

The responses of this group represent 33.7% of the sample and they suggest that the healthcare sector is expected to undergo a high degree of digitalization and modernization in the coming decades, but not without problems. The widespread adoption of digital tools and technologies and the increasing role of artificial intelligence and robotics can be expected. There is hope that digitalization can improve the efficiency and quality of healthcare and make the work of doctors and patients easier. At the same time, this group also considers it important to preserve the personal doctor-patient relationship, which is seen as less threatened by digitalization. The extent to which digitalization is progressing may vary between countries and regions, but overall, respondents expect greater digital development and uptake in healthcare.

> *"Making the final diagnosis, communicating with the patient, and performing surgery will remain the responsibility of the doctors. Furthermore, I have doubts about this, yet I strongly hope that digitalization will significantly reduce the*

administrative burden on doctors. This could make a huge difference to the quality of care. From simpler diagnostic tools (blood glucose meters, pulse and blood pressure monitors, quick tests that can be used at home, applications for recording vital signs) to the information they provide into the cloud accessible by the doctor, these would also improve the quality of care".

3) Neutral answers:

The digitalization of healthcare is an important topic according to the responses, with many aspects touched upon by participants. Responses from this group account for 34.7% of the sample and the following topics appear:

- Use of digital tools: several respondents predict that in the future we will use many more digital tools in healthcare.
- Digital systems and solutions: many cite the wider adoption of digital technologies and systems in healthcare, including electronic health systems and online communication.
- Doctor-patient relationship: as with moderately negative respondents, many participants stress that although digital technology will play an important role, the doctor-patient relationship will remain paramount.
- Speed and scale of digitalization: responses again express concern about the excessive spread of digitalization, mentioning infrastructural problems in the healthcare system and the lack of investment in modernising healthcare.
- Role of AI and technology: the growing role of AI and online communication in healthcare is mentioned by several respondents.

Overall, the responses suggest that digitalization is gradually gaining ground in healthcare, but it is important to strike the right balance between traditional and digital solutions and to take into account the importance of the doctor-patient relationship.

"...it is difficult to say, because technology is evolving so rapidly. Technology will certainly become much more widespread and digital tools will become a more integral part of healthcare. Whether this will bring positive change or whether it will have a negative impact on doctor-patient relationships, treatment procedures and the healthcare system as a whole, that's, unfortunately, impossible to predict."

4) Moderately negative responses:

Respondents in this group also account for 4.2% of the sample and responses indicate an increase in the role of digital tools in healthcare. At the same time, there is a strong confidence that the personal doctor-patient relationship will not be completely eclipsed, which is essential in healthcare. They express hope that digital smart devices will not take over the tasks of doctors and that some of the rounds will be digital. The presence and expertise of doctors are seen as important and they hope that digitalization will only minimally transform healthcare services. Overall, digitalization can lead to faster and more efficient care, but maintaining the personal touch is also a priority.

"....because by 2050 adults will be mostly 'children of the internet', they will be open to change and I hope that digitalization will be the way forward for healthcare. It would be very good for the environment and for efficiency. Healthcare workers might be replaced by robots, which I would not like because people will lose their jobs."

5) Negative responses:

Respondents in this group represent 4.2% of the sample and expressed the following: Many physicians find current digital tasks confusing, so they cannot be expected to adapt easily in the future. In addition, healthcare overload is not necessarily reduced by digitalization. Excessive digitalization of healthcare may be perceived as impersonal by patients and doctors alike. There are fears that doctors may pay less attention to patients. Furthermore, digital improvements may not be available in public care, and developments may mainly benefit patients in higher socio-economic status and in adequate financial situations.

"I fear that digitalization will become too prevalent in the health sector, as it is already a phenomenon (fortunately not too common at the moment) that doctors send patients for ultrasound, CT, X-ray, etc. I think, however, that if digitalization becomes too widespread in the health sector, doctors will become 'lazy' and will leave themselves and their patients to the devices, and I am very unhappy about this."

Conclusions

Our results from our population survey, as well as literature shows that patients have an open and trusting attitude towards the digital transformation of healthcare, which for them means more convenience, autonomy, and choice. (Safi 2018). This is supported in our research by the comparison of the two groups. In the population sample, many more respondents perceived a reduction in the number of doctor-patient appointments as a benefit, than in the student group. Saving time was equally important for both groups. A mixed interpretation of the quantitative and qualitative data shows that medical students in Hungary are open-minded and moderately optimistic about the digitalization of healthcare.

In our student sample responses, the availability of technologies, financial incentives and training at the educational level (in the educational and CME courses) are drivers for the subsequent use of digital opportunities. In addition to these, professionals need to have the motivation and the will to cope with the challenges, and healthcare leadership has a responsibility to create a positive atmosphere and supportive environment for their employees for successful adaption (Konttila 2019).

Before the COVID-19 pandemic, the 'Topol Review', a guideline for *'Preparing the healthcare workforce to deliver the digital future'* was published. In this document, the expertise team concluded that there is a need to raise awareness of digitalization among the health and social care workforce. There is a need to develop the skills, attitudes and behaviours that the medical workforce requires to become digitally competent and confident. We need to improve health-related digital competencies and behavioural readiness at the same time. (Marsilio 2024). These needs can also be seen in the responses from our survey based on the medical students' responses.

Acknowledgement

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References

Abou Hashish EA, Alnajjar H. Digital proficiency: assessing knowledge, attitudes, and skills in digital transformation, health literacy, and artificial intelligence among university nursing students. BMC Med Educ. 2024 May 7;24(1):508. doi: 10.1186/s12909-024-05482-3. PMID: 38715005; PMCID: PMC11077799.

Mesko B, Győrffy Z. The Rise of the Empowered Physician in the Digital Health Era: Viewpoint. J Med Internet Res. 2019;21(3):e12490. doi: 10.2196/12490. PMID: 30912758; PMCID: PMC6454334.

Safi S, Thiessen T, Schmailzl KJ. Acceptance and Resistance of New Digital Technologies in Medicine: Qualitative Study. JMIR Res Protoc. 2018 Dec 4;7(12):e11072. doi: 10.2196/11072. PMID: 30514693; PMCID: PMC6299231.

Konttila J, Siira H, Kyngäs H, Lahtinen M, Elo S, Kääriäinen M, Kaakinen P, Oikarinen A, Yamakawa M, Fukui S, Utsumi M, Higami Y, Higuchi A, Mikkonen K. Healthcare professionals' competence in digitalization: A systematic review. J Clin Nurs. 2019 Mar;28(5-6):745-761. doi: 10.1111/jocn.14710. Epub 2018 Nov 22. PMID: 30376199.

Marsilio, M., Calcaterra, V., Infante, G. *et al.* The digital readiness of future physicians: nurturing the post-pandemic medical education. *BMC Health Serv Res* 24, 885 (2024). https://doi.org/10.1186/s12913-024-11365-6

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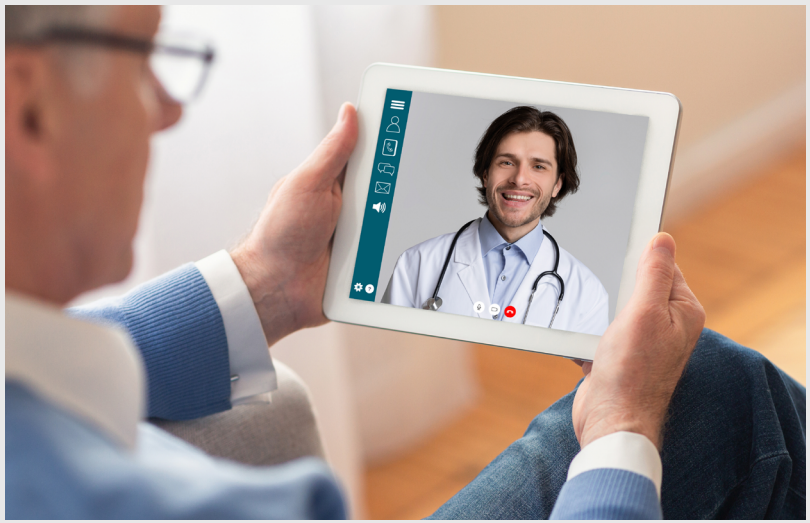
E-Patients in Hungary: Digital Health Experiences and Attitudes among Patients



Key Messages

- The COVID-19 pandemic has significantly accelerated the uptake of digital health solutions
- Digital health solutions are an integral part of care and there is a demand for them from the population
- Some patients are actively involved in managing their health by using digital solutions
- People over 60 are less active in searching for health-related information on the Internet
- The impact of educational background is strong, both in terms of information search and in knowledge and use of technologies
- People living in villages use significantly fewer digital health tools
- Our data suggest that the digital divide between socio-economic groups may be widening

Introduction

The COVID-19 pandemic has significantly accelerated the uptake of digital health solutions. The technology was available in most cases before, but its use for healthcare purposes was very limited. The key issue with the availability of technology is therefore the ability of doctors and their patients to adapt to new technologies. This is why digital health is not only a technological change, but also involves a transformation of the doctor-patient relationship, decision-making and health management (Meskó et al., 2017)

In Hungary, the technical conditions are partly in place for the uptake of digital solutions: 89 percent of households in the country have fast broadband internet. Connection speeds are outstanding, with 56 percent of homes having fixed broadband internet of at least 100 Mbps, compared to the EU average of 34 percent In January 2021, the last available data before the survey, 83 percent of the population were internet users and 73.5 percent were active social media users (Papp-Zipernovszky et al., 2021).

It is important to note that the survey was conducted in the middle of the COVID epidemic, so it is worth interpreting the data with this in mind. Since then, we have conducted another survey, the main results of which and a comparison with the previous data can be found at the end of this chapter.

Results

The table below shows the socio-demographic breakdown of our respondents.

Demographic profile		n	%
Gender	Female	699	46.6
	Male	801	53.4
Age group	18–29 years old	270	18.0
	30–39 years old	295	19.7
	40–49 years old	242	16.1
	50–59 years old	267	17.8
	60 years or older	425	28.3
Educational level	Elementary school or less	413	27.5
	Vocational school	338	22.5
	Secondary school, high school	480	32.0
	College, university or more	270	18.0
Settlement type of workplace	Budapest, capital	271	18.1
	County seat	270	18.0
	Town	526	35.0
	Village, countryside	434	28.9

WOMEN AS DIGITAL HEALTH MANAGERS?

Female respondents are more likely to seek information about health, illness, and they are the ones who are more likely to ask for help in doing searches. They are more prone to ask for help on social media platforms and are more likely to be members of online patient communities. Women indicated a higher proportion of searching medical interfaces and using professional journals. YouTube and other video-sharing sites, on the other hand, are male-dominated. Women are more likely to employ online appointment booking, e-prescriptions and telemedicine as well as emailing their doctor, sharing images and other electronic documentation. Women showed a higher preference for their doctor to recommend authentic websites, apps and sensors. Although more women use digital health solutions this does not necessarily mean that they are satisfied with it. They indicated to a greater extent that the use of digital technologies can make the doctor-patient relationship more impersonal, reduce the quality of care, increase over- and misdiagnosis. They are also more likely to agree with the view that technological difficulties can jeopardize secure care.

Health-related information seeking online

On average, people use 2.75 different internet sources for health information, while a quarter of respondents do not use any internet sources for health purposes. Women use significantly more internet sources for information than men (2.98 vs. 2.47). In

terms of age, it appears that 18-29 year olds (3.32) and 40-49 year olds (3.21) use the most sources, with significantly fewer (1.77) over 60.

The source of information is of paramount importance in the search for information. The results of the survey show that websites (e.g. Házipatika, Webbeteg -- these are Hungarian websites with valid health-related information) are the main source of information for respondents who use the internet to find health information, chosen by three quarters of respondents. This is followed by social media with almost 50% popularity, and 40% identified Facebook patient groups as a source of information. Other important sources are blogs (22.3%) and podcasts (16.8%). Interestingly, a quarter of patients (25.5%) who also use the internet for health information also report that they get information on health-related topics from professional journals. For these questions, respondents were given the option of indicating more than one answer. The survey did not ask respondents to name specific internet sources.

Women are significantly more likely than men to use social media (51.2% vs. 42.6%), social media groups and forums (39.8% vs. 26.6%) and medical journals (30.3% vs. 20.2%). Websites are significantly less used by those aged 60+ (62.6%), while podcasts and video sharing platforms are the most popular sources among the youngest (20.8% and 46.1% respectively), Facebook groups among 40-49 year olds (41.7%) and scientific search interfaces among 40-49 and 50-59 year olds (53.7% and 53.6%).

The proportion of people using websites increases with educational attainment, reaching 86.5% for graduates, but they have the lowest proportion of social media users (37.7%). The use of social media is highest among those with vocational school qualifications or at most a school-leaving certificate (52% and 51.9% respectively). Video sharing is least popular among those with the lowest educational background (32.1%), with the other groups having a usage rate above 40%. No significant differences are found for any of the internet sources by residence type of settlement.

The frequency of internet use for health purposes is daily for 13.1% of respondents, 22.6% use the internet weekly, 29.5% use the internet monthly, and less frequently, occasionally, 29.5% of respondents also search for information. Women are more likely to search on a daily (15.7%) and weekly (28.7%) basis, while men are significantly more likely to never use electronic health information sources (17%).

In terms of age, 19% of people over 60 years old use the internet daily, while 21% never use an internet health information source. By educational level, the proportion of never having used an Internet health resource is significantly higher among those with up to 8 years of education (23.1%), and decreases with the level of education: only 5% among those with higher education. No significant differences were found by residence type of settlement.

Even respondents who do not use the internet are not completely without information: almost half (48.2%) of them have a family member, relative or friend to help them find health information. This is particularly the case for people aged 60 and over and women, with 52.9% of respondents aged 60 and over not using the internet and 24% of women.

An important issue is timing, namely how this relates to seeking medical advice. More than one fifth (21.4%) of those who search for health information on the internet before consulting a doctor, 6.7% after consulting a doctor, 28.6% use internet sources both before and after consulting a doctor, and 43.3% do not use internet sources before or after consulting a doctor.

Respondents were also asked about their experience of how doctors perceive their patients' online health information searches. A fifth of respondents said that doctors dislike it, with around one-third to one-third (31.8% and 30% respectively) saying that doctors are neutral or very well received. 17% of respondents could not answer this. Older people and those with lower levels of education tended to feel that doctors were more open.

Knowledge of technologies

Almost everyone has heard of e-prescription, and there is over 80% awareness of online appointment booking and health monitoring sensors (e.g. smartwatch). Two thirds of respondents have heard of health apps and digital transmission of data and findings.

When looking at the number of known technologies, respondents have heard of 4.79 digital technologies on average and have used 2.22 technologies.

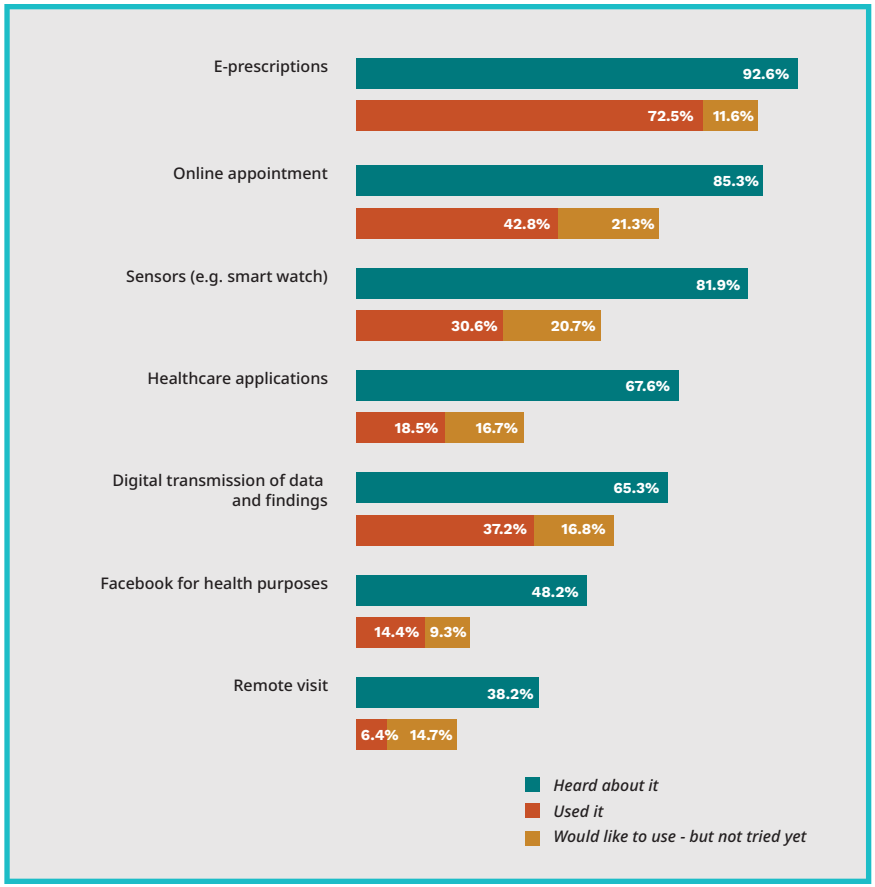


Figure 1: Have you heard about, use or would like to use the following digital health tools?

The ranking is similar to the ranking for digital technology knowledge, with e-recipe being the most popular, with nearly three quarters of respondents having used it. Online appointment booking and sensors are also popular, showing that they would like to use them but have not yet tried them. In terms of additional needs, more than half of respondents would like to use an app or sensor recommended by their doctor, almost half would like to browse websites with authentic medical information, or would like to have a teleconsultation or share their medical records with their doctor.

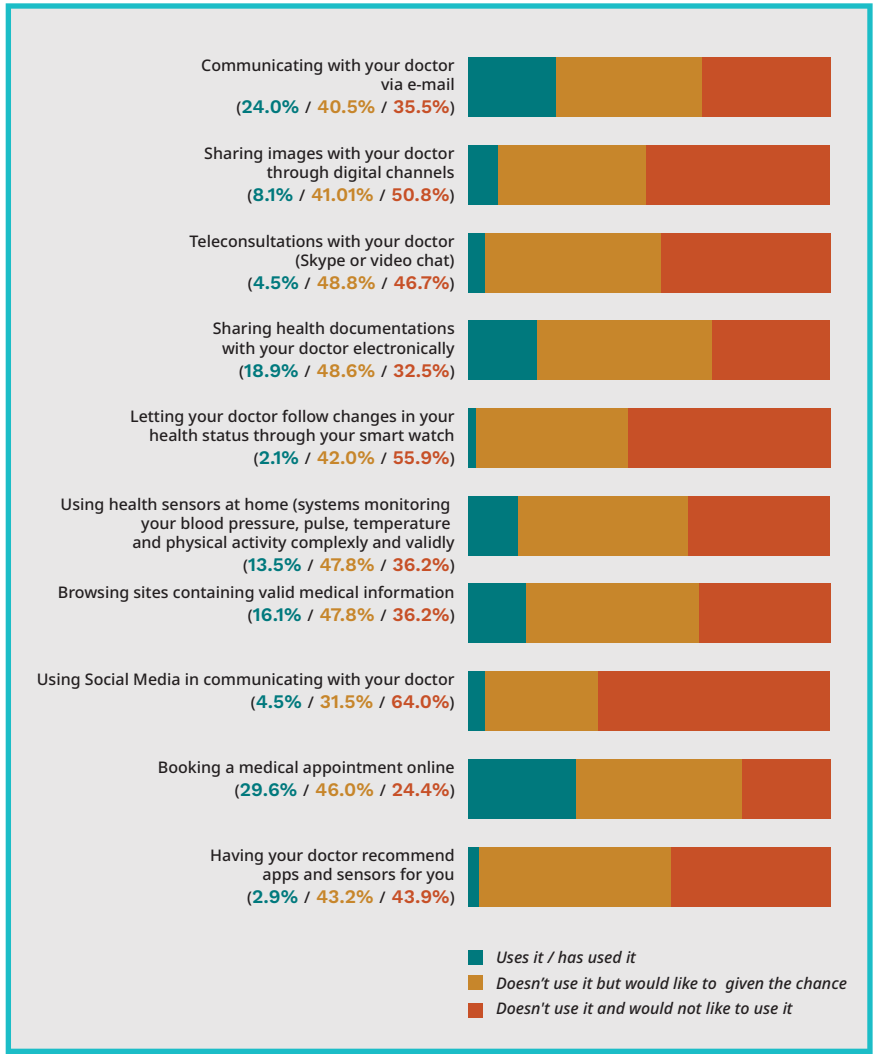


Figure 2: Which of the following options do you use or would like to use?

In the chapter on medical doctors, the other side of this issue is discussed in detail, i.e. what technologies doctors are familiar with and what they perceive as the needs of patients.

Perceived advantages and disadvantages of digital health solutions

Respondents expect that digital health tools will make care more convenient (90.2%), save time (88.8%), reduce the number of face-to-face doctor-patient encounters (83.3%), improve efficiency of care (74.8%), improve doctor-patient communication (70%) and help patients access care faster (69.8%).

In terms of disadvantages, respondents are most concerned about the impersonalisation of care (76.1%) and misinterpretation of the health information they share (72.3%). Potentially faulty technologies that could compromise patients' recovery are considered as a serious risk (68.5%).

The other side of this phenomenon, from our medical doctors' qualitative study, is that the other side of this phenomenon is that doctors perceive immediacy and immediate responses as an expectation on the part of patients, which means that on the one hand it is a convenience, and on the other hand it is an expectation. Also from the medical interviews, we know that it can indeed be a problem that patients misinterpret the information shared with them, or that they do not search properly and cannot necessarily judge the credibility of information.

Comparison with the 2024 survey

In February 2024, the research team conducted a new representative population study to examine how opinions and experiences of digital health solutions evolved after the COVID-19 outbreak. Below, the results of this more recent survey are compared with the data collected in the 2021 survey presented above.

Our results show a small increase in the proportion of the adult population who use the internet for health purposes (92% vs 87.6% in 2021), but a decrease in the daily frequency of internet use for health purposes (6% vs 13.1%). However, there has been an increase in the proportion of people who use the internet before/after visiting a doctor to find information. Websites are still the most popular source of information, but other internet sources such as social media, video sharing channels or online communities have declined slightly.

In terms of awareness and use of specific digital health technologies, e-Prescription, online appointment booking and smart devices and apps are the most popular, as in the 2021 survey, with nine out of ten adults who use the internet having heard of these technologies, but this was already similar 3 years ago. However, awareness of EESZT (Electronic Health Record - EHR) has increased significantly: less than three quarters of the population had heard of the relatively new system in 2021, but by early 2024 it will be close to 90%. Awareness of social media for health information is also high: in 2021, only half of the population had heard of this facility, but by 2024, two thirds had.

In terms of the specific use of these technologies, three quarters of the population were already using e-prescription in 2021, but this has increased further, with four out of five now using it. The proportion of people using online appointment booking and EESZT has also increased significantly, to more than two-thirds of the population (compared to less than half of the population before). The use of smart devices and sensors has also increased, with nearly half of the population now using them, compared to just over one-third before. The use of social media for health purposes has not only become more familiar, but is actually being used by more people: less than a fifth of the population in 2021, compared to more than two-fifths now.

Conclusions

Digital health solutions are certainly an integral part of healthcare, and the COVID-19 epidemic has certainly catalysed this significantly, as the technologies were already available, but the epidemic has led to greater use.

The results show that a proportion of patients are actively involved in managing their health, whether it is through seeking information or using technologies to support their health and healthcare.

When looking at the main demographic parameters of internet information seeking, there is no significant difference in awareness and use in the age groups below 60 years, but the over 60s use websites for health information less than the others.

In our study, we found that people with higher levels of education are more likely to use websites and less likely to gather health-related information from social media compared to those with lower levels of education. Those with higher education use a significantly higher proportion of scientific literature search sites. Those who have heard more about digital health solutions or get information about health from more sources see more benefits in digital health solutions. Type of settlement is not a determinant of how much and what kind of digital health tools respondents have heard about, but people living in villages use significantly fewer types of digital health tools.

The 2024 survey shows an increase in the knowledge and use of digital technologies and an increase in the proportion of people using health information online, but a decrease in intensity as the epidemic has passed.

The socio-demographic differences highlighted also highlight the potential for a widening digital divide between socio-economic groups.

The chapter is based on the following articles:

Girasek, E., Boros, J., Döbrössy, B., Susánszky, A., & Győrffy, Z. (2022). E-patients in Hungary: Digital health use and attitudes based on a representative nationwide survey. *Orvosi hetilap, 163*(29), 1159-1165.

Győrffy, Z., Boros, J., Döbrössy, B., & Girasek, E. (2023). Older adults in the digital health era: insights on the digital health related knowledge, habits and attitudes of the 65 year and older population. *BMC geriatrics, 23*(1), 779.

References

Meskó, B., Drobni, Z., Bényei, É., Gergely, B., & Győrffy, Z. (2017). Digital health is a cultural transformation of traditional healthcare. *Mhealth, 3*.

Papp-Zipernovszky, O., Horváth, M. D., Schulz, P. J., & Csabai, M. (2021). Generation gaps in digital health literacy and their impact on health information seeking behavior and health empowerment in Hungary. *Frontiers in Public Health, 9*, 635943.

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Vulnerable Populations and Digital Health in Hungary

Key Messages

- Vulnerable or underserved populations are those with complex and often more healthcare needs than the general population: older adults, people living with long-term activity-limiting impairment, and people experiencing chronic conditions
- Digital literacy and Internet connectivity have been called the super social determinants of health
- Digital health paradox: those who would benefit the most from digital technologies usually have the least the least access to them in terms of infrastructural goods or skills
- Attitudes of vulnerable populations: in 2021, older age groups have shown (slightly) less interest, people living with long-term activity-limiting conditions have had a more pessimistic stance than the overall population and these results persisted in 2024
- Vulnerable groups have less access to technologies in both 2021 and 2024 than the general population, however, access has increased in the past years
- Use of health-related technologies: for older age groups, online information seeking mostly means looking up websites; for people living with disabilities, Internet usage for health-related reasons was higher among people with severe activity-limiting conditions
- Our recommendation would be to design healthcare services and technology that are tailored to unique needs that might differ from the general population's preferences. For that, we need:
  - an appropriate scientific understanding of the problem
  - affordable and accessible services regardless of socioeconomic status
  - community initiatives, peer support, and social organizations promoting digital health technology

Introduction

As digitalization in healthcare has reached a tremendous extent in recent years, the target population of such products and services has also widened. Thus, the stratification of needs and responses is inevitable, and internalizing different aspects of diversity and inclusion is essential as various societal groups have different needs and require different solutions. This cannot be done without ensuring that technology developers, healthcare providers, and regulatory bodies represent diverse perspectives and experiences, and that novel technology is designed to cover a wide range of needs, such as the needs of underserved individuals (Győrffy et al., 2023).

There are at least three reasons why this is important. First, digital technologies are everywhere, and 21st-century existence, including the functioning of medicine, cannot be imagined without them. Access to such technologies started to determine access to appropriate high-quality medical products and services, meaning these technologies go beyond being luxury items and have evolved into mainstream everyday items with consequences even to how we perceive social determinants of health. That's why digital resources and skills, e.g. the Internet and digital literacy have been called the super social determinants of health as they started to determine how we can access housing, education, employment, or our social communities (Sieck et al., 2021).

Secondly, there is still a considerable digital divide that prevents equal access to affordable digital technologies for the vast majority of the global population, which in turn, started to determine access to healthcare from the reasons explained above. Such access can be understood in terms of access to resources, skills, and supportive social contexts. Although the COVID-19 pandemic has considerably narrowed the digital divide, and the usage gap has markedly narrowed in the last 5 years (from 50 percent in 2017 to 41 percent in 2022 on average (*The Mobile Economy 2023*, n.d.)), research estimates that in 2024, there are still 2.6 billion people worldwide without Internet access not to mention other technologies (Vestberg, 2024).

Thirdly, these populations have a disadvantage when it comes to access to proper healthcare as individuals, but also on the community level. A community embedded in a resilient ecosystem with a strong digital component could more successfully reduce the disadvantageous effects of any future crisis as it would represent a strong reserve in case of any systemic breakdown such as the ones experienced during the COVID-19 pandemic waves, and with balancing out inequalities, the digital health component would build up reserve capacities in society to improve the abilities of the most vulnerable in the face of future shocks (Győrffy et al., 2023).

The Digital Health Paradox and Vulnerable Populations

Governments, public and private healthcare providers, and even physicians and patients in many countries already recognized the benefits of digital technologies in healthcare, such as the improvement of health outcomes, the increase in access to health systems, or the reduction of efficiency gaps in medical processes. However, there is a growing body of evidence indicating that greater reliance on digital tools has the potential to widen the gap between those who have digital skills and resources and those who do not, thereby increasing already existing health inequalities.

Although digital solutions might be designed following guidelines, such as the World Health Organization (WHO) Global Strategy on Digital Health 2020-2025, which states that "digital health should be an integral part of health priorities and benefit people in a way that is ethical, safe, secure, reliable, equitable, and sustainable," certain groups might be unintentionally left out of the digitalisation boom (*Global Strategy on Digital Health 2020-2025*, n.d.). Such groups might not have access to digital resources due to their geographical location, socioeconomic status, or cultural contexts, or they might not have appropriate digital skills due to their barriers in age, educational background, or ability-related constraints. Paradoxically, these groups often represent patients with complex psychosocial needs, specific sociodemographic characteristics, and multiple chronic conditions, and they would greatly benefit from the use of digital health technologies. van Kessel et al. have referred to this as the digital health paradox (van Kessel et al., 2022).

This chapter elaborates on examples of the digital health paradox regarding vulnerable populations in Hungary, such as two age groups of older adults and people living with long-term activity-limiting impairments. People experiencing homelessness also fall into this category, and the next chapter will expand on their situation extensively.

Study Samples

The results presented in this chapter are based on two population surveys. The first was conducted as a national telephone questionnaire survey among the Hungarian population focusing on digital health-related knowledge, attitudes, and needs, and was completed in 2021. The sample size was 1500 and it was representative of the adult population of Hungary in terms of gender, age, type of settlement, and education.

The second one was conducted as an online questionnaire among the Hungarian population, and it focused on the same questions. The sample size was 1000, and it was also representative of the adult population of Hungary in terms of gender, age, type of settlement, region, and education.

The below table shows the demographic composition of the two samples regarding those subpopulations that we are specifically interested in in this chapter: older populations, people with long-term activity-limiting conditions.

Population Survey 2021			**Population Survey 2024**	
n	**%**		**n**	**%**
		Gender		
699	46.6	Male	474	47.4
801	53.4	Female	526	52.6
1500	100	Total	1000	100
		Age group		
270	18	18-29 years old	160	16
295	19.7	30-39 years old	157	15.7
242	16.1	40-49 years old	199	19.9
267	17.8	50-59 years old	163	16.3
246	16.2	60-74 years old	214	21.4
182	12.1	75 years and above	107	10.7
1500	100	Total	1000	100
		Activity-limiting conditions		
74	4.9	severe disability	53	5.3
198	13.2	non-severe disability	264	26.4
1220	81.3	no disability	674	67.4
1492	99.5	Total	991	99.1

Main Results

1) Attitudes towards technologies

When comparing the 2021 and 2024 population surveys, while keeping in mind their methodological differences and thus some limitations for the comparison, it can be detected that the usage of digital health technologies is somewhat more widespread in 2024 than in 2021.

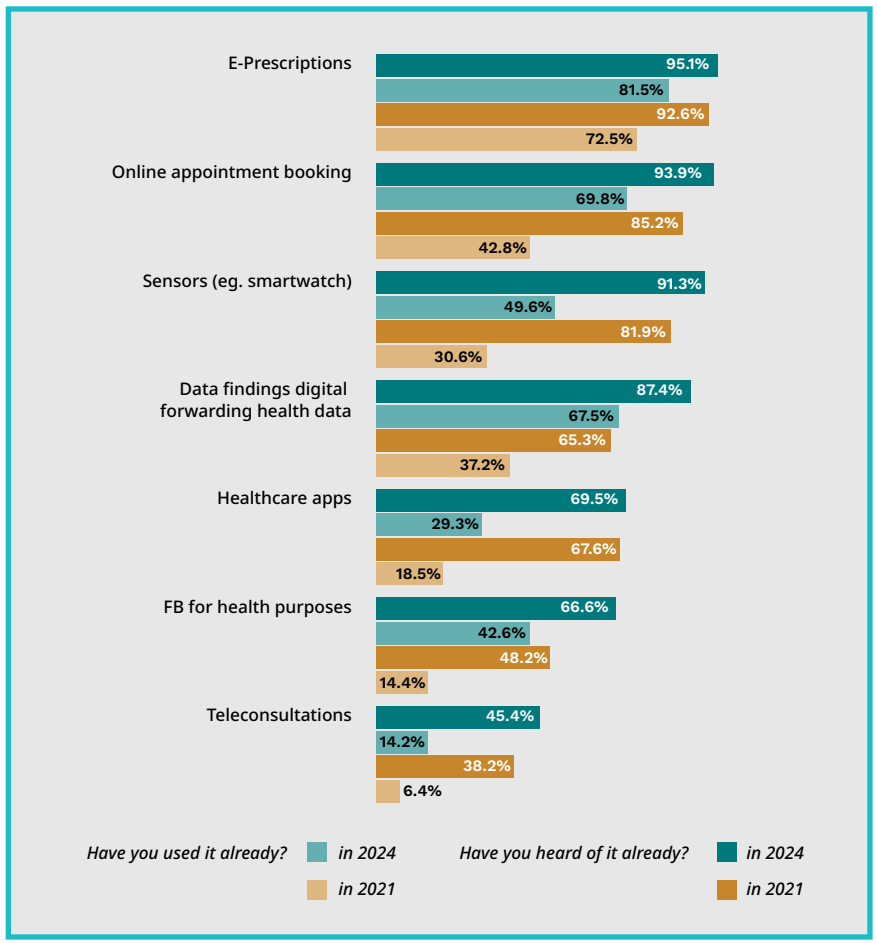

Figure 1: What digital technologies have patients heard of and what have they already used?

When the older adult age group is considered specifically, in the 2021 population survey, **older adults in various age groups** reported significant interest in digital technologies: only a quarter of 65–74-year-olds (26.5%) and a third of 75+-year-olds (31.9%) responded they would not like to try digital technologies in the future, while nearly 70% of both age groups would like to learn about such tools – but still, above 60 years old, interest in digital health technologies dropped significantly compared to the general population (Győrffy et al., 2023). Only 23.7 percent said explicitly that they would like to use digital technologies.

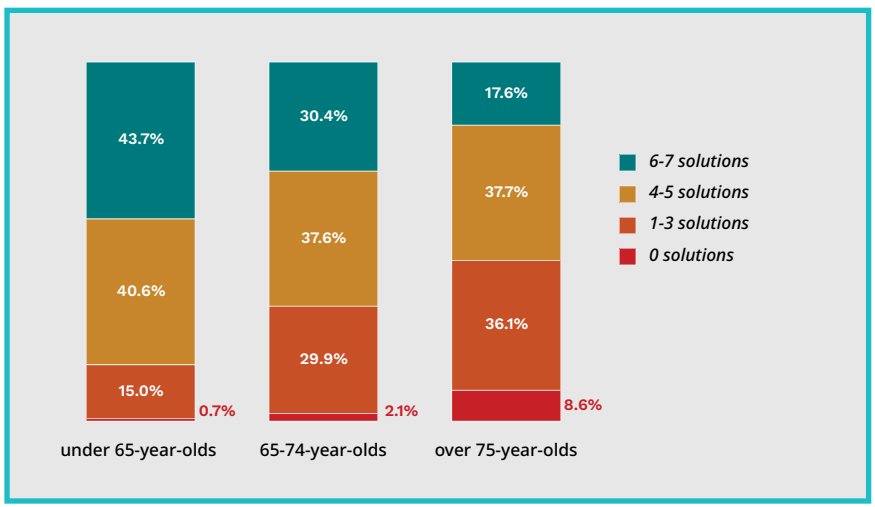

Figure 2: How many digital health solutions have you heard of? (e-prescription, online appointment scheduling, sensors, applications)

In terms of future usage wishes, almost a quarter of the respondents (23.6 percent) would like to use smart sensors and wearables (smartwatch, smart scale, pulse oximeter, etc.), while 18.2 percent would like to try applications (sleep monitoring, blood glucose monitoring), 17.1 percent would like to try online scheduling and online referral to specialist care, and 13.1 percent is open for telemedicine.

In the 2024 survey, regarding the two older population groups, 22.4 percent of 60-74-year-olds said they would like to try such tools, while 8.6 percent of the above 75-year-olds seemed open to such novelties. Smart sensors and wearables were the most popular in both age groups. However, it is worth noting that the 60-75-year-old age group showed the highest number of respondents being open to trying digital health technologies. The reason for this phenomenon might be that the spread of digital health technologies has already advanced, and early adopters, as well as members of the early majority, have already joined in and are using online prescription of medicines, online scheduling, telemedicine, while the older age group still faces very similar barriers as they might have had at the beginning of the pandemic (Warty et al., 2021). As Győrffy et al. found, the need for digital solutions increases with the level of education and the more benefits one perceives in using digital solutions (Győrffy & Girasek, 2023). Also, the literature notes that in terms of digital technologies, attitudes, and abilities are among the most powerful predictors of technology use when it comes to older age groups (Charness & Boot, 2009).

People living with long-term activity-limiting conditions are less open and more pessimistic than the general population when it comes to digital health technologies. In the 2021 survey, they reported finding fewer benefits and more limitations. There was a significant difference in the number of benefits of digital solutions mentioned (people living with long-term activity-limiting conditions: mean = 7.4, n = 272, reference group: mean = 7.7, n = 1,228; p = 0.02) and the number of perceived disadvantages as well (people living with long-term activity-limiting conditions: mean = 6.1, n = 272, reference group: mean = 5.6, n = 1,228; p = 0.005) (Győrffy et al., 2023).

In the 2024 survey, the more pessimistic stance of this population remained visible. For the question, if you think of the usage of digital health solutions, such as applications, smartwatches, smart wearables, or other sensors, what feelings you perceive, 50.9 percent of those people who live with severe activity-limiting conditions, responded that they do not have any feelings about these tools. In comparison, 28.3 percent said they have either bad or very bad feelings about them. A Chi-square test showed an association between a more pessimistic outlook in terms of usage of digital tools and activity-limiting conditions, meaning that the more severe these conditions were, the more pessimistic individuals got about these technologies.

2) Access to technologies

According to our 2021 population survey, 43.9% of **older adults** accessed the Internet at least once a month (as compared to 81.3% of the total population) and they were significantly less likely to search for health information online as well. This remarkable difference was seen in the use of other digital health solutions. While 42.8% of the population have booked medical appointments online, only 27.9% of older adults have done so. Their use of e-prescriptions was 10 percentage points lower than that of the general population (76.4% vs. 86.4%). Older adults also used mobile health applications (14.3% vs. 27.3%) and smart devices or sensors (13.7% vs. 37.3%) less.

Interestingly, in the 2024 population survey, the use of e-prescriptions among the general population has not changed significantly (85.6 percent), however, higher percentages of older age groups utilized it. 85 percent or more respondents of the above 40 age groups said that they have been using e-prescriptions, which could mean that the wide availability of the technology in the last three years was enough for this population to catch up. As a side note, however, we have to consider the fact that to use e-prescriptions, you need only minimal levels of digital health literacy and technological skills, as it digitizes an interaction between medical professionals. In terms of other technologies, the digital divide remained: the use of smart devices or sensors was significantly less in this population, 15.5 percent compared to that of the general population (49.6 percent), while data for mobile health applications even showed a decrease of use in this population (7.1 percent vs. 29.3 percent), which might mean that they tried these tools but gave up their use, or they only used it or found it useful during the pandemic. The literature also notes that application interface and design can also present a barrier to older age groups (Aslan et al., 2024).

According to the 2021 population survey, **people living with long-term activity-limiting conditions** utilized digital health technologies to a lower extent than the general population. For example, digital transmission of health-related data to medical professionals was used by 58.5% of people with no activity limitations, 34.8% of people with mild activity limitations, and only 25.7% of people with severe limitations. Smart sensors, wearables, and smartwatches were used by 32.8% of people with no activity limitations, 21.7% with mild limitations, and 17.6% of people with severe limitations.

In terms of smart sensors, smartwatches, and wearables, the situation for people living with long-term activity-limiting conditions seems to have changed for the better in the last couple of years. In the 2024 population survey, we found that 33.9 percent of those with severe limitations have been using smartwatches, smart scales, or other sensors/smart tools, while 52.6 percent of those with mild limitations and almost half (49.8 percent) of those with no activity limitations answered similarly, although only 912 people responded to the question in the survey, which limits our results. However, this shows a positive change in terms of access to resources for people living with disabilities.

3) Health-related use of technology

In the 2021 survey, the results for the question “Do you use the Internet for health-related reasons?” showed the phenomenon that might be linked to the digital health paradox outlined in the introduction. While among the general population, 71.3 percent responded that they do use the Internet for such reasons, it was only 54.0 percent in the 60-74-year-old group, 36.9 percent in the group of people living with long-term activity-limiting conditions, and even less, 30.3 percent among the above-75-year-olds. These populations show patterns of less access in terms of physical and cognitive resources, although they might benefit more from digital solutions than the general population.

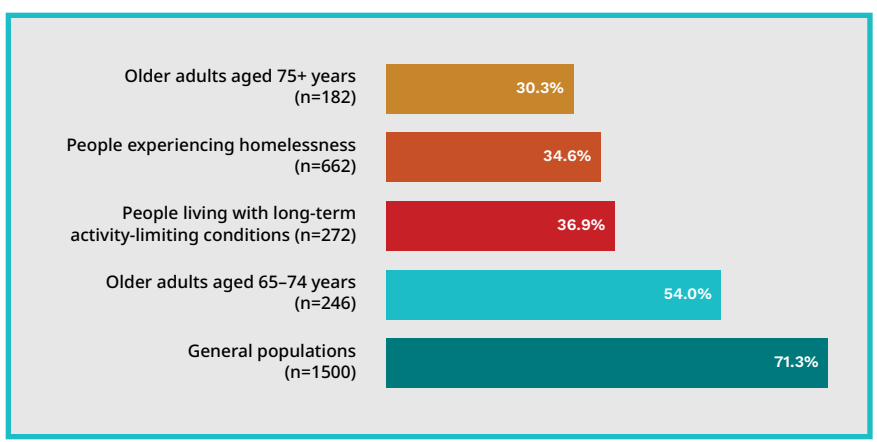

Figure 3: Rate of health-related Internet use among vulnerable groups compared to the general population in Hungary. Methodology explainer: “Yes“ responses (%) in a representative survey (n=1500) in Hungary in vulnerable groups and “Yes“ responses (%)of people experiencing homelessness in Budapest, Hungary in a survey (n=662) for the question: “Do you use Internet for health-related reasons?“

In the case of older adults, the 2021 population survey found that regular Internet use for health-related purposes meant mostly accessing websites. One in two older respondents received support in finding their way around the web. There are almost no people under 65 (0.7%), a small proportion of people aged 65-74 (2.1%), and one in twelve people aged 75+ who have never heard of any digital health solutions. Our results show that around 70% of respondents in both age groups have used more than one digital health solution and almost the same proportion of respondents in the older age groups expressed a sustained need for more than one digital solution (Győrffy et al., 2023).

According to the 2024 population survey, there are slight changes regarding older age groups and health-related Internet usage. When it comes to information seeking online, the main sources of information are still websites - nothing else comes even close to their popularity. In terms of asking for help when looking up information online, 42.4 percent of people over 60 asked for help, which seems as an incremental decrease. For the question, of whether the respondent can decide to what extent online accessed health-related information is credible, all age groups responded similarly: the majority said both yes and no, which indicates a general uncertainty around online health information.

The 2024 survey included a question about how the respondent used online health information: before or after going to the doctor. Interestingly, there was no significant difference between age groups meaning that around a third of the respondents said that they seek out online health information both before and after visiting their physician, however, a significantly larger ratio of the youngest age group (18-29 year-olds) only consulted websites and other online information sources before going to the doctor.

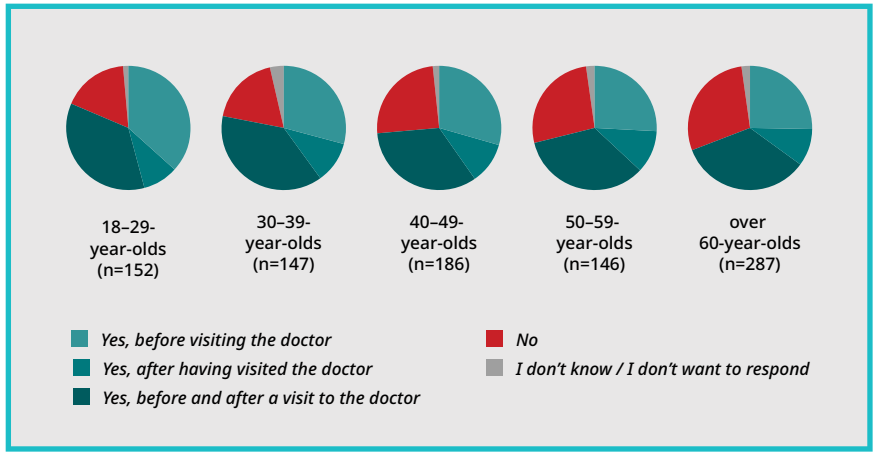

Figure 4: Do you typically use health-related online information also in the case of turning to a doctor with your health problem?

People living with long-term activity-limiting conditions

Although in the 2021 survey, people living with long-term activity-limiting conditions showed a definite interest in digital health solutions (almost half of them would like to use various digital health technologies like smartphone telemonitoring (43.8%) or teleconsultation (40.5%)), the regular use of these technologies was only 18.7% and 4.5%. In the case of using the Internet for health-related reasons, we could see a huge gap between the average population (71.3 percent) and this specific one (36.9 percent).

However, in the 2024 survey, an interesting phenomenon has surfaced. On the one hand, usage has widened: only 15.4 percent of the respondents said that they do not use the Internet, and on the other hand, Internet usage for health-related reasons was higher among people with severe activity-limiting conditions. More than a third of them said they either used the Internet daily or weekly for health purposes, while most respondents with less severe activity-related conditions said they used the Internet for such purposes weekly (34.8 percent), while most respondents with no disability to constrain their lives said that they used the Internet for health-related purposes monthly or less frequently (42.3 percent). The Chi-square test also showed an association between long-term activity-limiting conditions and Internet usage patterns for health reasons.

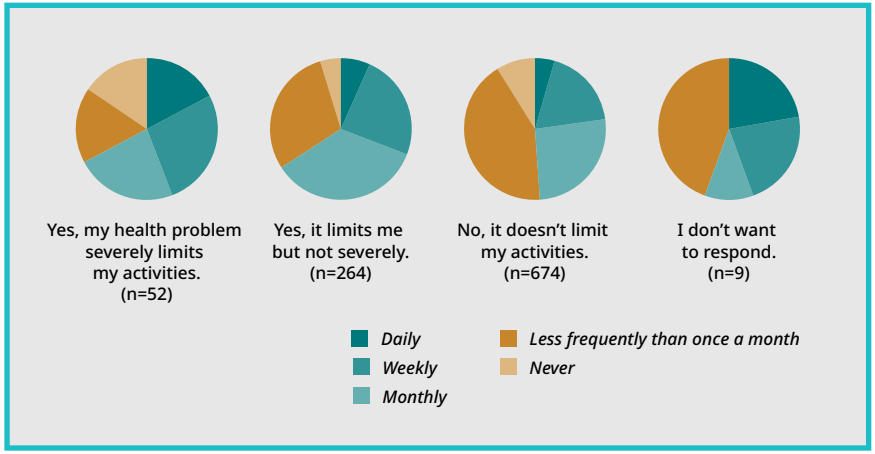

Figure 5: Do you have any health problem or impairment (vision, hearing or mobility impairment, mental health trouble) that limits your abilities to carry out everyday tasks? How often do you use the Internet for gathering health- and illness-related information?

Conclusions

Vulnerable populations such as the elderly or people living with long-term activity-limiting conditions in Hungary might not benefit as much from the digital transformation of the healthcare system boosted by the COVID-19 pandemic in the last couple of years, as the general population. This situation might result in the digital health paradox, meaning that those who would benefit the most have the least benefit from digital technologies.

That is the reason why when designing healthcare services and technology, the unique needs of the target populations have to be taken into account. This statement seems self-explanatory, however, there are still technology and service developers who tend to go reluctantly beyond the 'average user' be that the user of digital health technology or a patient in a telemedical consultation.

The needs and social circumstances have to be especially considered in the case of vulnerable populations, as their situation and preferences might profoundly differ from those of the general population. That's why it is of utmost importance to widen our scientific knowledge about the problem and draw up potential solutions, which facilitate the increase in both resources and skills. For example, the provision of affordable, accessible, and sustainable products, services, and infrastructure regardless of socioeconomic status would result in more equitable access to the super social determinants of health for vulnerable populations, which might result in better patient outcomes. Community initiatives, peer support, and social organizations promoting digital health technology and the uptake of digital skills might change the cultural context and would result in an increase in digital literacy, which might also lead to more favorable medical outcomes. In the next chapter, we will analyze how people on the very brink of society, those experiencing homelessness fit into the evolving digital health landscape, and look at how all these factors interact in their case.

The chapter is based on the following article:

Győrffy, Z., Döbrössy, B., Radó, N., Boros, J., & Békási, S. (2023). State of vulnerable populations in the techquity framework in Hungary. *Frontiers in Public Health, 11*, 1215325. https://doi.org/10.3389/fpubh.2023.1215325

References

Aslan, A., Mold, F., van Marwijk, H., & Armes, J. (2024). What are the determinants of older people adopting communicative e-health services: A meta-ethnography. *BMC Health Services Research, 24*, 60. https://doi.org/10.1186/s12913-023-10372-3

Charness, N., & Boot, W. (2009). Aging and Information Technology Use. *Current Directions in Psychological Science, 18*. https://doi.org/10.1111/j.1467-8721.2009.01647.x

Global strategy on digital health 2020-2025. (n.d.). Retrieved April 30, 2024, from https://www.who.int/publications/i/item/9789240020924

Győrffy, Z., Döbrössy, B., Radó, N., Boros, J., & Békási, S. (2023). State of vulnerable populations in the techquity framework in Hungary. *Frontiers in Public Health, 11*, 1215325. https://doi.org/10.3389/fpubh.2023.1215325

Győrffy, Z., & Girasek, E. (2023). *Digital Health Among the Elderly in Hungary — Brief Research Report*. https://semmelweis.hu/digitalhealth/files/2023/05/Idoskutatas-2023_2023-03-31.pdf

Sieck, C. J., Sheon, A., Ancker, J. S., Castek, J., Callahan, B., & Siefer, A. (2021). Digital inclusion as a social determinant of health. *Npj Digital Medicine, 4*(1), 1–3. https://doi.org/10.1038/s41746-021-00413-8

The Mobile Economy 2023. (n.d.).

van Kessel, R., Hrzic, R., O'Nuallain, E., Weir, E., Wong, B. L. H., Anderson, M., Baron-Cohen, S., & Mossialos, E. (2022). Digital Health Paradox: International Policy Perspectives to Address Increased Health Inequalities for People Living With Disabilities. *Journal of Medical Internet Research, 24*(2), e33819. https://doi.org/10.2196/33819

Vestberg, H. (2024, January 14). *How can we bring 2.6 billion people online to bridge the digital divide?* World Economic Forum. https://www.weforum.org/agenda/2024/01/digital-divide-internet-access-online-fwa/

Warty, R., Smith, V., Salih, M., Fox, D., McArthur, S., & Mol, B. W. (2021). Barriers to the Diffusion of Medical Technologies Within Healthcare: A Systematic Review. *IEEE Access, PP*, 1–1. https://doi.org/10.1109/ACCESS.2021.3118554

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Digital Health and People Experiencing Homelessness in Hungary

Key Messages

- In the case of people experiencing homelessness, a complex set of social determinants of health is at play, which amplifies each other's impact and leaves this vulnerable group at the extremely low end of health outcomes, healthcare access, and health literacy.
- Attitudes: we found that this population is as open to telemedicine as the general population and those more satisfied with healthcare services in general, manifest more openness to telecare.
- Access to technologies: 52.9 percent of people experiencing homelessness have been using the internet, 69.6 percent reported mobile phone ownership and 39.9 percent added their phone had a smartphone function.
- We found significant digital device ownership combined with health-related internet use: 34.6 percent reported having ever used the internet for medical purposes.
- A digitally engaged homeless group exists and helps their peers when they need digital problem-solving.
- We conducted a successful telemedicine pilot project with a high participation rate and positive patient and physician feedback. The online visits proved to be medically relevant as well: due to regularly checking chronic disease parameters between two visits, successful therapy modifications were also conducted.
- The inclusion of this population in the digital health ecosystem has the potential to offer them better access and health outcomes via technological solutions.

Introduction

In the previous chapters, patients and physicians and their functions and relations to technology in an emerging digital health ecosystem were analyzed. However, they were rather looked at as a homogenous group with some distinctive demographic characteristics – such as age or place of residence -, but that perspective cannot detect the subtleties that we started to cover in the previous chapter and aim to continue here. Namely, the differences in socio-economic backgrounds that result in differences in access and attitudes to healthcare, health literacy, and health outcomes in general. These differences also appear when looking at the digital health ecosystem, and as the previous chapter explained, they could result in the digital health paradox.

Nowhere is the digital health paradox more visible than in the case of the homeless population. Being at the extremely low end of the socio-economic ladder, their social and health-related characteristics create a unique group of people hardly comparable to the general population. Thus, in our research agenda, we mainly relied on quantitative and qualitative data stemming from this population and only compared the results in certain cases to a reference population.

Life expectancy data for people experiencing homelessness compared to the general population clearly shows that this vulnerable group is at the extremely low end of health outcomes, healthcare access, and health literacy. For example, a systematic review found that socially excluded populations had an eight times higher mortality rate for men and 12 times higher for women than the average population (Aldridge et al., 2018). In Western, high-income countries, studies have also shown that homelessness was an independent risk factor for mortality, and life expectancy varies between 50-65 years on average. According to previous research, living without adequate housing options is associated with significantly higher rates of bacterial and viral infections, diabetes, hypertension, cardiovascular disease, mental health issues, or problematic substance use compared to populations with adequate housing options (Radó et al., 2024).

Thus, complex unmet healthcare needs are frequently present, coupled with structural barriers to obtaining healthcare services. Research also shows mistrust of healthcare systems and experiences of discrimination in care settings. Poorer health literacy measured among people experiencing homelessness compared to the general population might also lead to poor self-rated health status and less adherence to medical recommendations and prescription medicine (Radó et al., 2024).

These unmet healthcare needs are coupled with restricted access and usage of digital technology. Previous research shows that people with lower socioeconomic status are slower to adopt new technology, and the rates of smartphone and internet use of people experiencing homelessness were lower than for those with similarly low socioeconomic status but more stable housing (Raven et al., 2018; VonHoltz et al., 2018). On the other hand, previous research also says that it would have ample benefits to equip people experiencing homelessness with the necessary tools to get them involved in digital health ecosystems, as the costs of inclusion are significantly lower than the treatment of health conditions, while the overall benefits show significance and persistence.

As a very first attempt in Hungary, our research group in cooperation with the Hungarian Charity Service of the Order of Malta (HCSOM) aimed to map out the attitudes towards digital health technologies of people experiencing homelessness, their access and usage patterns to analyze whether their inclusion in the digital health ecosystem would be a feasible and beneficial option what are the systemic barriers and enabling factors for its realization? Both a quantitative and a qualitative study were completed, moreover, the research group and HCSOM launched a pilot telemedicine project as a preliminary study of a long-term comprehensive telemedicine program. This pilot was also an opportunity to set out recommendations for an overarching digital health inclusion program for people experiencing homelessness in Hungary.

Study Samples

As part of our research agenda, we conducted two cross-sectional surveys, one about the attitudes of people experiencing homelessness towards telemedicine and another one about their access to digital resources and internet usage patterns. Additionally, 12 in-depth interviews were completed for a qualitative research framework.

1) Attitude survey sample

The survey was completed by people experiencing homelessness (n=98) in four shelters providing mid- and long-term accommodation in Budapest, Hungary. Three of the shelters were operated by HCSOM and one shelter was operated by a partner institution (Shelter House Foundation). Data collection took place between 14–21 April 2020. During this period, the shelters were under lockdown due to the COVID-19 pandemic. Comparison was made with data from a Hungarian weighted reference group of non-homeless persons recruited from 2 primary care units (n = 110) (Győrffy et al., 2022).

2) Access study survey sample

Between April 19, 2021, and August 11, 2021, a total of 662 people from 28 institutions providing social services for people experiencing homelessness in Budapest,were surveyed about their access to digital tools and internet use patterns (Radó et al., 2022). For selected questions, the responses of a representative sample of the Hungarian population were used for comparison as a reference group. This representative survey was conducted by our research group between October 5, 2021, and October 13, 2021, and consisted of responses from 1500 Hungarians (Girasek et al., 2022).

3) Qualitative study sample

As a continuation of the quantitative study on digital health access and usage patterns, 12 semi-structured, in-depth interviews were conducted on the topic of digital health usage among people experiencing homelessness. Interviewees were selected based on the following criteria: (1) clients in the social care system of HCSOM, (2) use the Internet every second week or more frequently, (3) access the Internet with their own smartphone or computer or tablet or another device with a data contract, pay as you go facility or free WIFI, (4) rate themselves average or more competent Internet-users, (5) have ever used the Internet for health-related reasons. In the final analysis, 10 interviews were included (Radó et al., 2022).

4) Telemedicine pilot project sample and study design

The results of the attitude survey encouraged the research group to organize a pilot project for telemedical services. The final structure of the study, inclusion and exclusion criteria, documentation, and response to possible emergency situations were determined during focus group discussions with the participating physicians (*n* = 3) and on-site assistants (*n* = 4) before the patient recruitment phase.

Afterward, a total number of 75 adult participants were recruited in four weeks (between Feb 8 and March 7, 2021) from four shelters providing mid and long-term accommodation to people experiencing homelessness in Budapest. For participating in the pilot, only one inclusion criterion was applied: the client had to have at least one pre-existing chronic condition that required regular medical follow-up. Each participant was invited to six online telecare visits biweekly (every two weeks) with a focus on the medical management of chronic conditions. The online visits took place on an appointment basis and keeping appointments was facilitated by on-site assistants in the homeless shelters. During the pilot (March 10 and July 30, 2021), 92.2% (n = 415) of originally planned visits were delivered and 55 clients (73.3%) attended the full program. After the completion, focus group discussions were organized for both physicians and on-site assistants to summarize their experiences, and a follow-up survey among available previous clients in all four shelters was completed after four to six months of pilot closure, between November 9 and December 7, 2021 (Békási et al., 2022).

Summary Table of Research Items

Research Item	Attitude Study	Access Study	Qualitative Study	Pilot Project
Sample size	n=98	n=662	n=10	n=55 (75 recruited)
Participating institutions	4 homeless shelters	28 homeless services, including street outreach teams	4 homeless shelters	4 homeless shelters
Study duration	14–21 April 2020	April 19, 2021, and August 11, 2021	August 18 and October 27, 2022	Recruitment: between Feb 8 and March 7, 2021 Pilot: March 10 and July 30, 2021 Follow-up: November 9 and December 7, 2021
Control Group	non-homeless persons recruited from 2 primary care units (n = 110)	representative sample of the Hungarian population for selected questions	No control group	No control group

Main Results

1) Attitudes Towards Healthcare and Technologies: Cautious Openness

The quantitative survey measuring attitudes of people experiencing homelessness towards telecare found that a significant fraction of homeless individuals with mid- or long-term residency in homeless shelters did not oppose the use of telecare via live online video consultation and there was no difference compared to the national reference group. Although these results supported a general openness of this population, a subpopulation of homeless persons who reported struggles with getting access to healthcare services were more likely to favor in-person doctor-patient consultations. Overall, the results of the homeless group indicated that those more satisfied with healthcare services, in general, manifested more openness to telecare.

When we conducted the qualitative study via interviews with members of the digitally engaged group of people experiencing homelessness, the responses to questions about subjective experience and attitude regarding novelties or technology, as well as towards the healthcare system modulated the findings from the attitude study. Regarding openness towards technologies in general, the subgroup demonstrated mixed attitudes with a dominant openness in their overall stance, which is in line with the attitude study. In almost half of the interviews (4 interviews), openness toward trying new programs and applications appeared, while in 2 interviews, a complete lack of interest was reported.

The topic of trust and mistrust as well as its potential consequences in utilizing healthcare services also appeared in the qualitative study. Some interviewees mentioned the feeling of being unwelcome in conventional healthcare settings, which was in line with previous research (Baggett et al., 2018). Some of them mentioned difficulties in getting appropriate treatment and a negative attitude from healthcare personnel, which negatively influenced their desire to seek healthcare in the future and their overall trust in the healthcare system. This might explain their turn away from mainstream healthcare solutions.

2) Access to Technologies: a Solid Base to Build On

The results of the cross-sectional quantitative study measuring the access of people experiencing homelessness to digital tools as well as their health-related internet use showed that a significant share of this population has been using the internet (52.9 percent). When we compared this number to the representative sample of the Hungarian population used as a reference group, 81.3 percent said that they were using the internet. Although there was a sizeable difference between the two groups, there was a significant number of people experiencing homelessness who had access to technology - much more significant than what the research group expected before conducting the study itself. Moreover, 69.6 percent of people experiencing

homelessness reported mobile phone ownership, while 39.9 percent added their phone had a smartphone function as well. Personal computer and tablet use was also mentioned, but smartphones were the dominant devices. That means more than one-third of this population had access to smartphones and could actively join digital ecosystems offering services to citizens such as digital health solutions.

The qualitative study underpinned our findings: the majority of interviewees (7/10) had smartphones, which are more accessible to people with a low socioeconomic status (Woods et al., 2017). As a need, device supply was primarily mentioned by the participants in both studies, in the access study, 21.4% of respondents mentioned the lack of a smartphone as the main barrier to not using the internet and 24.1% mentioned that the availability of an appropriate device would help them use the internet more (Radó, 2022).

Shared digital devices, such as computers of the shelters, were available to the participants of the qualitative interviews, and in some hostels, free Wi-Fi or charging opportunities were also provided. The majority of participants (6/10) looked for free Wi-Fi options outside the shelters as well. One interviewee mentioned the lack of free Wi-Fi on public transport services and the lack of installation of smart banks in Budapest as barriers to usage. Such infrastructural problems were also mentioned as causes of non-usage by 7.6% of respondents in the access study. On the other hand, several interviewees mentioned using paid services of internet cafes to charge their phones or use Wi-Fi.

In our recommendations, we suggested city planners and municipalities to provide free Wi-Fi in public spaces and/or mass transport options as these measures would make digital services more accessible to the most vulnerable. We also suggested telco companies to work together with NGOs and civil organizations to offer device and service packages that would be more accessible to this population. These possibilities could lay down a strong foundation for the participation of this group in a digital health ecosystem as well as any other digital service system.

3) Health-related Internet Use: New Ways to Find Solutions

The access study showed that 34.6 percent of the homeless population reported to have already used the internet for medical purposes, which is around one-third of the respondents. When we conducted the qualitative interviews, we created questions to deep-dive into the potential characteristics and reasons for health-related internet use. It turned out that people experiencing homelessness used their devices primarily to search for health-related information, and also as new channels to reach solutions for their health problems outside the conventional healthcare system - if that system did not seem to provide an acceptable solution for their problems.

In several interviews, information seeking for medical purposes was reported. For example, interviewees looked up prescribed medications (5 interviews), active ingredients of medications (4 interviews), medicinal herbs believed to replace certain pills (2 interviews) or foods, and natural materials (1 interview). One interviewee mentioned purchasing a product believed to have medicinal value online based on a Facebook advertisement.

One interviewee in their 30s communicated with the doctor about health problems via email, provided information about their illness and the prescribed medicines online and used a health app and a step counter. These tools (health app and step counter) were also mentioned by 2 other interviewees, however, one of them stopped using the step counting option as they believed it was inaccurate.

4) Health-related Internet Use in Practice: A Telemedicine Pilot Project

All these findings showed great promise for involving people experiencing homelessness in the digital health ecosystem and gave the research group preliminary ideas about where to start such an involvement. The results of the attitude study provided a solid base for believing that a telemedicine pilot project might be successful as the population seemed to be generally not less open towards telecare than the average population.

Thus, the research group planned, designed, and conducted a telemedicine pilot project in 2021. During the pilot, 92.2% (n = 415) of originally planned online visits were delivered and 55 clients (73.3%) attended the full program of six appointments. Both the patients' and physicians' overall satisfaction was very high (4.52 and 4.79, respectively, on a 5-point Likert scale) and the patients' overall rating remained similarly high during the follow-up. Comparing the first and sixth visits, physicians

reported significant improvements in almost all aspects. The linear regression models proved that confidence in the patients' assessment and diagnosis had the most prominent effect on the physicians' overall rating, while ease of use and lack of communication gaps influenced the patients' rating most positively.

The telemedicine pilot project was a unique and highly successful undertaking, which since its inception has already been introduced as part of a regular health portfolio in the HCSOM system. In 2023, three institutions helping people experiencing homelessness (Miklós Street Integrated Homeless Care Center, Baptist Charity Service's REVIP Temporary Hostel, and Shelter House Foundation's Night Shelter – the latter institution was unfortunately closed in August 2023 due to lack of funds) have started online primary care, which has been accessed by more than 100 people so far (DocRoom, 2024). Telemedicine not only helps the continuous control of chronic patients, but it has also already saved lives through early diagnosis of severe non-communicable diseases.

Conclusions

People experiencing homelessness constitute a hugely underserved and understudied population, and our research agenda fills in significant gaps in the literature. Especially, since the majority of studies on the homeless population is still conducted in North American and Western European countries, although such populations in Central and Eastern Europe have their own, unique characteristics.

As people experiencing homelessness live on the extremely low end of society, with their own health limitations and illness-related behaviors, it is difficult to compare this population to other societal groups. That's the reason why we only used the Hungarian representative sample as a reference group concerning a couple of research questions and we generally compared our findings to homeless experiences that we gathered through different research methods.

However, no matter how, understudied and underserved this population may be, a lot more could be gained from their inclusion in the digital health ecosystem. We believe that it would result in the biggest gain for solving the digital health paradox: as their access to digital health tools and services would be ensured in a more equal, equitable, and sustainable way, their gain in health outcomes would be significant and long-lasting.

Our research already shows that people experiencing homelessness can be involved in the digital health ecosystem as they are open enough, have enough access to technologies, and present appropriate levels of usage. Moreover, we even found a digitally engaged subgroup. When we conducted a qualitative interview study to explore their characteristics, it turned out that they even help their peers solve their technological issues and they might even be a starting point for a digital literacy program. Our telemedicine pilot project turned out to be highly successful, and even catalyzed significant changes in the organization and was introduced on an institutional level, where it still operates as a promising complementary tool to traditional primary care. These all underpin that an overarching digital health program with a focus on the inclusion of vulnerable populations, such as people experiencing homelessness would be viable and successful in the long run.

The chapter is based on the following articles:

Békási, S., Girasek, E., & Győrffy, Z. (2022). Telemedicine in community shelters: Possibilities to improve chronic care among people experiencing homelessness in Hungary. *International Journal for Equity in Health, 21*, 181. https://doi.org/10.1186/s12939-022-01803-4

Győrffy, Z., Békási, S., Döbrössy, B., Bognár, V. K., Radó, N., Morva, E., Zsigri, S., Tari, P., & Girasek, E. (2022). Exploratory attitude survey of homeless persons regarding telecare services in shelters providing mid- and long-term accommodation: The importance of trust. *PloS One, 17*(1), e0261145. https://doi.org/10.1371/journal.pone.0261145

Radó, N., Békási, S., & Győrffy, Z. (2024). Health Technology Access and Peer Support Among Digitally Engaged People Experiencing Homelessness: Qualitative Study. *JMIR Human Factors, 11*, e55415. https://doi.org/10.2196/55415

Radó, N., Girasek, E., Békási, S., & Győrffy, Z. (2022). Digital Technology Access and Health-Related Internet Use Among People Experiencing Homelessness in Hungary: Quantitative Survey. *Journal of Medical Internet Research, 24*(10), e38729. https://doi.org/10.2196/38729

References

Aldridge, R. W., Story, A., Hwang, S. W., Nordentoft, M., Luchenski, S. A., Hartwell, G., Tweed, E. J., Lewer, D., Vittal Katikireddi, S., & Hayward, A. C. (2018). Morbidity and mortality in homeless individuals, prisoners, sex workers, and individuals with substance use disorders in high-income countries: A systematic review and meta-analysis. *Lancet (London, England), 391*(10117), 241–250. https://doi.org/10.1016/S0140-6736(17)31869-X

Baggett, T. P., Liauw, S. S., & Hwang, S. W. (2018). Cardiovascular Disease and Homelessness. *Journal of the American College of Cardiology, 71*(22), 2585–2597. https://doi.org/10.1016/j.jacc.2018.02.077

DocRoom. (2024, March 13). *First year of telemedicine in service of people experiencing homelessness.* https://docroom.hu/en/first-year-of-telemedicine-in-service-of-people-experiencing-homelessness/

Girasek, E., Boros, J., Döbrössy, B., Susánszky, A., & Győrffy, Z. (2022). [E-patients in Hungary: Digital health use and attitudes based on a representative nationwide survey]. *Orvosi Hetilap, 163*(29), 1159–1165. https://doi.org/10.1556/650.2022.32512

Raven, M. C., Kaplan, L. M., Rosenberg, M., Tieu, L., Guzman, D., & Kushel, M. (2018). Mobile Phone, Computer, and Internet Use Among Older Homeless Adults: Results from the HOPE HOME Cohort Study. *JMIR mHealth and uHealth, 6*(12), e10049. https://doi.org/10.2196/10049

VonHoltz, L. A. H., Frasso, R., Golinkoff, J. M., Lozano, A. J., Hanlon, A., & Dowshen, N. (2018). Internet and Social Media Access Among Youth Experiencing Homelessness: Mixed-Methods Study. *Journal of Medical Internet Research, 20*(5), e184. https://doi.org/10.2196/jmir.9306

Woods, S. S., Forsberg, C. W., Schwartz, E. C., Nazi, K. M., Hibbard, J. H., Houston, T. K., & Gerrity, M. (2017). The Association of Patient Factors, Digital Access, and Online Behavior on Sustained Patient Portal Use: A Prospective Cohort of Enrolled Users. *Journal of Medical Internet Research, 19*(10), e345. https://doi.org/10.2196/jmir.7895

Szilvia Zörgő

Assessing the Needs of Online Diabetes Support Groups to Make Recommendations for Future Development

Key Messages

- Health-related needs of persons with chronic diseases manifest on online forums, where many turn to for psychosocial support and information retrieval
- Diabetes requires a high-level of self-management (regarding lifestyle, technology, psychosocial negotiations, etc.), the challenges and intricacies of which can be accessed on social media platforms (e.g., Facebook)
- The contents of examined posts and comments showed that providing help and social support were salient, those experienced in disease-management were active in guiding the newly diagnosed
- First-hand and practical information was highly-valued in issues where conventional healthcare does not extend, such as the effects of time differences and day-light savings on meal times, travel advice, and alternative spots to administer insulin
- An infrequent, but crucial aspect of group discourse involved members asking others for insulin or offering up their own unused insulin; further investigation is warranted, as dissatisfaction or distrust toward healthcare providers was not a marked motivation behind this behavior
- Much of the examined content regarded ensuring a sense of support and community to those sharing problems, questions, or experiences, but social regulation was also frequent, in terms of negotiating the quality and validity of offered advice
- Based on findings, future infrastructure development should integrate blood glucose monitoring with manual inputs on diet and insulin use, along with features such as peer connectivity for sharing information on lifestyle and organizing social events

Introduction

The objective of this sub-study was to assess the digital health-related needs, knowledge, and attitudes of a chronically ill population in Hungary through a social media platform to make recommendations for infrastructure development in the digital transformation process that serves the needs of patients more effectively.

Social media platforms were of particular interest because they represent a hub of social support, where patients obtain information regarding the disease with which they are living, the symptoms they suffer from, and share personal opinions and experiences. Such platforms serve as a proxy for emotional and informational support in distress arising from demanding self-care regimes, which are the hallmark of chronic illness (Herrero et al., 2021). Furthermore, patients often report a perceived lack of "real-world" knowledge among healthcare providers or system contributors, which they prefer to address with social support outside of the medical setting (Oser et al., 2020).

Diabetes is currently one of the most prevalent chronic diseases; the number of people with diabetes (PWD) in the US has tripled in the past 20 years with figures also increasing in Europe (Stellefson et al., 2019), reaching 7 percent in Hungary (above the EU average) (OECD/European Union, 2020). Such a disease, which requires self-management in the domains of e.g., symptom-control, nutrition, sleep, and exercise, provided a well-rounded field of inquiry in light of our objectives, while Facebook, as one of the most popular social media platforms, especially for connecting people with chronic illnesses (Herrero et al., 2021; Statista, 2020; Stellefson et al., 2019), connoted an appropriate arena for exploring complex patient needs.

Study Sample

We searched for diabetes-related public groups on Facebook operating with Hungarian content and retaining a minimum of 100 members, with at least one new post a week. Two such groups fit our inclusion criteria; Group 1 had 2800 members at the time of preregistration, Group 2 had 1900 members. We limited scraped data to after March 13, 2020, the beginning of the first COVID-related lockdown in Hungary; this restriction was implemented because we surmised that pre- and post-COVID discourse (and hence expressed needs) would differ greatly and should not be included into the same sample. In total, 200 threads were included in the analysis.

Main Results

Qualitative description of group discourse

The most prominent content of patient communication within posts and comments was providing help to peers regarding lifestyle, namely, patients discussing diet-related issues, exchanging recipes, and conversing about weight-related questions. Patients most frequently solicited help from others regarding lifestyle (e.g., content and timing of meals), health products (e.g., herbs, OTC products, complementary medicine), and pharmacological products used in conventional diabetes care. Help was also solicited and provided regarding the interpretation of diabetes-related symptoms (e.g., the normalcy or frequency of pain and various sensations, weight gain).

Non-solicited information sharing in posts and replies also chiefly concerned lifestyle-related topics, for example, disclosing what an individual had for a meal. Additionally, blood glucose levels were frequently shared without any accompanying information. Lifestyle-related posts were often met with explicit social support content, such as inter-member positive feedback and encouragement concerning diet, and words of comfort regarding changes in body weight. Aside from welcoming new members into the group and greeting each other on national holidays, social support also manifested in the normalization of diabetes-related symptoms and encouragement concerning blood glucose levels. Non-solicited information was also shared concerning insulin use, types of diabetes medication, and experienced or anticipated side-effects of these. The most commonly mentioned side-effect was weight gain. Diabetes care-related instruments were not commonly mentioned, but manifested as discussion on what blood glucose monitoring devices and test strips are the best and where to buy them. There were no mentions of diabetes-related apps or websites.

Both groups exhibited instances of social regulation, that is, assessing the quality and reliability of shared information; correcting, warning others about fraud or danger; and negotiating the validity of information. Social regulation most prominently occurred in connection to lifestyle-related topics (e.g., particular food or ingredient), which were negotiated in comments under a post. Explicit mentions of satisfaction or

dissatisfaction with a conventional doctor, pharmaceutical, or the healthcare system in general were uncommon.

Posts in the first group were more focused on providing help and support to group members, the discussion of symptoms and pharmaceuticals, as well as providing lifestyle advice, with instances of social regulation in negotiating the validity of shared information. Conversely, in the second group, post content was saturated with non-solicited information sharing on lifestyle (especially meals), symptoms (especially weight gain), and blood glucose levels. The second group exhibited much fewer content on pharmaceutical information.

Quantitative description of group discourse

The above description is based on the co-occurrence of our codes constituting the content analysis of included posts. Figure 1 shows the strength of association between unique pairs of codes. The most prominent codes in the mean network of the entire dataset were *GiveHelp* and *Lifestyle*, which exhibited strong connections to each other. The code *GiveHelp* also exhibited strong associations to *Products*, *Pharma*, and *Symptoms*. Non-solicited information disclosure *(Share)* was almost exclusively connected to *Lifestyle*, which, in turn, was strongly associated with both *Social Support* and *Social Regulation*. The least connected code was *Instruments* (devices, test strips, etc.).

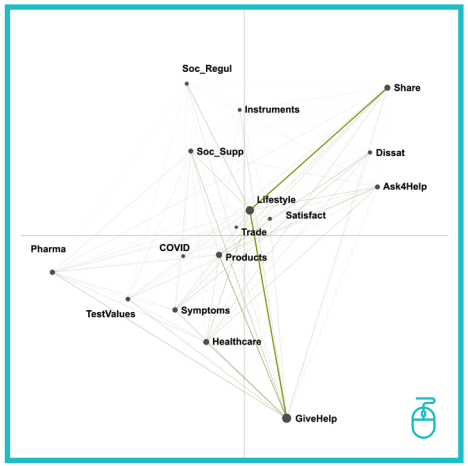

Figure 1. Mean epistemic networks for diabetes self-help group 1 (red, left) and group 2 (green, right) showing the weighted structure of connections among codes employed in content analysis. The thickness of the edges (lines) indicates the relative frequency of co-occurrence between each pair of codes; the size of the nodes (black circles) indicates the relative frequency of each code within that group.

Critical Themes in Group Discourse

Initiation and guidance

One key characteristic of the examined content was experienced PWD guiding newly diagnosed patients regarding basic illness- and self-care related information. Such mentorship was given, for example, on how insulin works and why it is commonly associated with weight gain. Also, mentorship emerged concerning the differences between types of insulin, side-effects of medication, and symptoms. Diet and nutrition signified another salient domain where inter-member guidance was frequently provided.

Oser et al. argue that a need to receive and provide psychosocial, technical, informational, and age-specific peer support in diabetes self-management is common, emphasizing that more experienced PWD may feel the need to provide the same kind of support they themselves received earlier on in their illness trajectory (Oser et al., 2020) (cf. (Greene et al., 2011)). Asking for help was less dominant in our networks, indicating that a single request for information or feedback was usually met with many responses providing support.

Illness intricacies

Members exchanged information on a variety of issues that may not arise in conventional care settings, such as: the effects of time differences and day-light savings on meal times, travel advice, alternative spots to administer insulin and how often one should shift injection location, whether it is safe to use insulin past its expiration date, what a "good" pre-breakfast glucose level is, and why glucose levels fluctuate despite adhering to conventional recommendations. These issues were not only addressed, but responded to promptly by group members with first-hand experience. First-hand experience was also exchanged regarding blood glucose meters (specific brands and their advantages), complimentary therapies (products and home remedies), and diabetes-friendly groceries (specific brands and locations to buy).

Patient-driven discourse often leads into domains that do not generally receive attention in conventional care, such as travel-related and other "street-level" disease-management information (Greene et al., 2011), which signify a vital part of successful self-care. Due to the plurality of participants (Greene et al., 2011) in such support groups (e.g., patients, family members, advertisers, healthcare workers living with diabetes), the potential repository of (mis)information is vast and bears the capacity to address a wide array of issues.

COVID-related intricacies

The onset of COVID introduced a new topic of discourse among group members that, due to many reasons, may not have been easily discussed with their provider, namely: which vaccine they were offered by their GP and which they prefer, whether or not to get a vaccine at all, how great of a risk diabetes presents in contracting COVID and complications that may arise. Due to the fact that diabetes patients denote a high-risk population for contracting SARS-CoV-2 (Singh et al., 2020), we were expecting COVID to be a salient topic within our data. Despite this, the code representing this topic did not exhibit a high co-occurrence frequency, and its manifestations were mostly regarding the different vaccines in the time preceding their rollout in Hungary. This indicates that patients were more keen on discussing potential side-effects of various vaccines than disclosing e.g., post-immunization experiences or risk. Also, since we limited posts to after the first lock-down in Hungary, much of COVID-related content may have been excluded from the sample.

The "insulin trade"

Despite it being infrequent, a crucial aspect of group discourse involved members asking others for insulin or offering up their own unused insulin. In some instances, members were left without insulin when they reportedly could not reach their provider, on other occasions, members were prescribed different medication and were left with a surplus of the previous drug. These initiatives were posted publicly but then negotiated privately among individuals involved in the trade.

The precise motivations behind this online behavior (answering a clearly existing demand) warrant further investigation. Our data suggests that dissatisfaction or distrust toward healthcare providers is not a marked motivation behind this "informal insulin trade". Neither satisfaction nor dissatisfaction were voiced in our sample, as it exhibited a low frequency vis-à-vis other codes included in the content analysis. Thus, "venting" about challenges and frustrations was not as prominent in our sample as was elsewhere (Oser et al., 2020).

Social Support and Regulation

A vital feature of group discourse was ensuring a sense of support and community to those sharing problems, questions, or experiences. Social support manifested in encouraging others in continuing their diet, congratulating individuals on their adequate glucose levels, and providing positive feedback on shared experiences, test values, recipes, and external resources (links to diabetes-related information). Social support was often accompanied by social regulation, especially when more contestable statements were made; strong opinions emerged on COVID vaccines, specific foods, and determining adequate glucose levels. When the validity of a claim was contested, it was usually negotiated until a group consensus seemed to emerge.

The term "biosociality" was coined for describing acts of peers jointly constructing and shaping self-care knowledge and behaviors based on lived experience (Kingod, 2020). In our sample, code co-occurrences of *Social Support* and *Social Regulation* frequently manifested as "biosocial" negotiation regarding specific pieces of disclosed information (glucose levels, nutrition, etc.). Some studies have examined the content and outcomes of biosocial negotiation in terms of validity; for example, Greene et al. state that only 3% of posts in their sample contained inappropriate or unsupported therapeutic information (Greene et al., 2011). Despite studies suggesting

claims on online forum discussions are by-and-large clinically sound, the potential for misinformation to spread is still present if discourse is left “unsupervised” by medical professionals (Greene et al., 2011).

Implications for eHealth infrastructure development

About a dozen apps accessible to Hungarians have been developed for PWD, which are available in Hungarian and English. Most of these apps provide help regarding diet, nutrition, and exercise, as well as measuring and tracking blood glucose levels. Less common, albeit potentially useful functions, include the possibility to contact peers through social media platforms, and, via manually entered data, a warning function to forecast the consequences of a poorly chosen meal on glucose levels. Another useful and increasingly common function is the ability to store and transfer data from a glucose meter to a telephone application, enabling values to be downloaded and presented during medical consultation.

Building on our finding that giving and receiving peer support, normalization and validation, and “street-level” information, as well as performing biosocial negotiation on a plethora of topics were all prominent features of diabetes support group functioning, existing eHealth tool functionality could be aggregated and augmented in several ways. For example, it would be beneficial if an application could be integrated with the blood glucose meter, and would automatically record each value. That log could be supplemented with manually entered information on diet (consumed food and drinks as well as their date and time) and insulin use (time and administered dose). These jointly could warn patients when glucose levels are not adequate and provide positive feedback when they are optimal. This app could also have a function for connecting peers based on location, allowing them to share information on e.g., suitable restaurants, exercise programs, and groceries at specific stores in the area. Peer connectivity could also lead to the organization of location-based social events or illness-, symptom-specific social support. Additionally, open peer-to-peer invitations to exercise programs could enhance participation, as social support is a known driver of adherence to exercise regimes. Furthermore, enabling a way to continue asynchronous chat would be ideal, perhaps on a forum where information could be periodically reviewed by a practitioner. Optimally, the app could be downloaded and used not only by patients, but their physician and/or their dietitian, which, if necessary, would provide them with information on the administered treatment, glucose levels, and nutrition. This aggregated functionality would cater to a population that is, according to our survey (see the chapter about Digital Health Experiences and Attitudes among Patients), increasingly employing digital tools and resources.

Conclusions

Modern medicine is increasingly becoming “participatory” in the sense that patients are no longer passive participants, but are active and well-informed in their own therapeutic process. Chronic disease in particular, requires autonomous self-management and patient participation. Digital healthcare places both doctors and patients in a new set of circumstances; we aimed to explore the possibilities and potential dangers inherent in digital healthcare and to describe effective solutions to a wide audience.

The chapter is based on the following article:

Zörgő, S., Jeney, A., Csajbók-Veres, K., Mkhitaryan, S., Susánszky, A. (2022). Mapping the Content Structure of Online Diabetes Support Group Activity on Facebook. In: Wasson, B., Zörgő, S. (eds) Advances in Quantitative Ethnography. ICQE 2021. Communications in Computer and Information Science, vol 1522. Springer, Cham. https://doi.org/10.1007/978-3-030-93859-8_15

References

Greene, J. A., Choudhry, N. K., Kilabuk, E., & Shrank, W. H. (2011). Online social networking by patients with diabetes: A qualitative evaluation of communication with Facebook. *Journal of General Internal Medicine, 26*(3), 287–292. https://doi.org/10.1007/s11606-010-1526-3

Herrero, N., Guerrero-Solé, F., & Mas-Manchón, L. (2021). Participation of Patients With Type 2 Diabetes in Online Support Groups is Correlated to Lower Levels of Diabetes Self-Management. *Journal of Diabetes Science and Technology, 15*(1), 121–126. https://doi.org/10.1177/1932296820909830

Kingod, N. (2020). The tinkering m-patient: Co-constructing knowledge on how to live with type 1 diabetes through Facebook searching and sharing and offline tinkering with self-care. *Health (London, England: 1997), 24*(2), 152–168. https://doi.org/10.1177/1363459318800140

OECD/European Union. (2020). Diabetes prevalence. In *Health at a Glance: Europe 2020: State of Health in the EU Cycle*. OECD Publishing. https://doi.org/10.1787/83231356-en

Oser, T. K., Oser, S. M., Parascando, J. A., Hessler-Jones, D., Sciamanna, C. N., Sparling, K., Nease, D., & Litchman, M. L. (2020). Social Media in the Diabetes Community: A Novel Way to Assess Psychosocial Needs in People with Diabetes and Their Caregivers. *Current Diabetes Reports, 20*(3), 10. https://doi.org/10.1007/s11892-020-1294-3

Singh, A. K., Gupta, R., Ghosh, A., & Misra, A. (2020). Diabetes in COVID-19: Prevalence, pathophysiology, prognosis and practical considerations. *Diabetes & Metabolic Syndrome, 14*(4), 303–310. https://doi.org/10.1016/j.dsx.2020.04.004

Statista. (2020). *Social media penetration rate in Hungary in 2020, by platform.* https://www.statista.com/statistics/1115256/hungary-social-media-penetration-by-platform/

Stellefson, M., Paige, S., Apperson, A., & Spratt, S. (2019). Social Media Content Analysis of Public Diabetes Facebook Groups. *Journal of Diabetes Science and Technology, 13*(3), 428–438. https://doi.org/10.1177/1932296819839099

Zsuzsa Győrffy

Perspectives

Based on our 4 year investigation, we observed that the demand for digital health solutions among patients has remained stable and even increased after the COVID-19 pandemic. Telemedicine, wearables and the patient portals are an integral part of health and illness behaviour especially for younger age groups. Patients are looking for convenient, time-saving (digital) care, but still appreciate the personal encounter time with their physicians. Our findings highlighted that the doctor's consultation can likely never be fully replaced, but it can be enhanced with the assistance of digital technology.

Omnichannel Patient Experience and "Physicians as Beacons of Guidance"

In 2024, we have found that surveyed patients prefer the convenience of online appointment booking, telemedicine consultations, the ability to view lab results through the EESZT portal, on-demand access to their healthcare providers, online chat support and the option to visit in person. In summary, they desire an "omnichannel patient experience."

Our data showed that after the COVID-19 pandemic, patients' needs have increased: more than 80 percent of patients want to communicate with their doctor by email, 60 percent are open to telehealth, more than 80 percent would like to use a health sensor, nearly the same number would like their doctor to recommend trusted internet sources to them. A high proportion (over 70 percent) also indicate that they would like to receive recommendations for apps from their doctor. It is clear that the primary reference person for digital health information and orientation in Hungary is the physician. This means that physicians play a crucial role in guiding patients through the complexities of digital medical care, providing comfort and expertise, and helping them make informed decisions about their health.

Digital Health Solutions Can Potentially Enhance Patient Adherence

The most important finding of our physician's survey is that in comparison to their older counterparts, young doctors say that enhanced patient adherence, increased patient involvement in the healing process and heightened patient cooperation are the greatest benefits of digital health solutions. A clear connection emerged between young doctors, active patient involvement in the treatment process - and the pivotal role played by digital technologies in facilitating this engagement. Additionally, our results highlight the indispensable nature of a proper patient-provider relationship for the successful participation and adherence process which is based on mutual communication, data sharing and joint decision making.

Senior Care

The number of people aged 65 and over is 10 percent of the population globally, which is expected to increase to 16 percent by 2050. The bio-psycho-social approach to health and disease is complemented by a digital component and, in addition to the classic three factors, is of enormous importance in shaping health status (Ahmavand 2018). At the same time, getting connected to the digital world, being well informed and competent in the use of tools is a huge challenge for all generations. Our research has shown that the older age group also has measurable digital health needs, so helping them on this journey is in the interest of the whole health ecosystem. Younger people are more open to using digital solutions. The differences between the two age groups of elderly people (65-75 and above 75) - and the fact that the under 65s are better adapted in all respects raises the possibility that the specific trends in digital health for older people will virtually disappear in 10 years' time (when the under 65s now enter this age group).

Health Equity and Techquity

Digital literacy and Internet connectivity have been termed the super social determinants of health, as emerging technologies increasingly permeate healthcare systems in developed countries (Sieck 2021). Promoting digital inclusion is also a key objective of the European Commission. "Techquity" refers to the intentional design and implementation of technology to advance health equity and avoid perpetuating systemic inequities and health disparities. It is founded on the pillars of trust in technology, access to it, initial adoption, and sustained engagement (Clark 2021).

In Hungary, the digital health revolution was rapidly accelerated by pandemic-related policymaking, but cultural adaptation is still lagging. Our studies revealed that vulnerable populations, including older adults, individuals with activity-limiting conditions, and people experiencing homelessness use digital health solutions significantly less than the general population. Despite facing severe barriers to using these solutions, all three groups expressed unmet needs and a motivation to adopt health technologies.

Digital Trust

Trust is a pillar of the doctor-patient relationship. It affects the possibilities of access to care, is essential to adherence, compliance, and patient satisfaction, and improves clinical outcomes (Adjekum 2018). Based on our studies among homeless persons, we may assume that in telecare, considerable trust is required between the service provider and the recipient. People who feel they receive adequate care have a bigger chance of having trust in telecare, too. In this population, 'digital trust' is not primarily related to information privacy and security concerns or having faith in technology. Here, trust is more related to having access to quality care and conditions necessary for the continuity of care (Asan 2020).

Digital Technologies May Be Able to Reduce Burnout

Another significant result of our studies is that physicians think that digital technologies may potentially be able to reduce burnout. According to the study of Rotenstein et al. nearly half of all healthcare workers suffered from burnout during the COVID-19 pandemic (Rotenstein 2023). The 2023 Physician Burnout & Depression Report of Medscape entitled 'I Cry but No One Cares,' is a survey of more than 9,100 doctors representing 29 specialties. This study concludes that 53 percent of physicians experienced burnout last year, which is a six percent increase from 2021. Nearly a quarter of the surveyed physicians reported having been depressed, up from 15 percent in 2018. Our pre-pandemic Hungarian data shows that medium or high level personal accomplishment was present in 75.9% of surveyed doctors and emotional exhaustion in 58%. The moderate level depersonalization subscale was 53% (Győrffy 2015). All 3 aspects showed association with being under 35 years old, working in in-patient care, shift hours and multiple workplaces.

Evidence is still scarce, but it tends to point to the burnout-reducing potential that digital health may have. Nevertheless, we must say that initially EHR was demonstrated to negatively influence clinician well-being, contributing to clinician burnout (Wosny 2023). Digital health solutions can improve job satisfaction and reduce burnout by supporting clinical decision-making and reducing administrative tasks. Digital solutions can save time, minimize repetition, improve teamwork and reduce unnecessary visits (Craig 2021). One of the main sources of burnout in healthcare is the overwhelming amount of administrative and repetitive tasks. For example, AI can take over administrative tasks, using natural language processing, computer vision, speech recognition, and machine learning to streamline workflow. The uncertainty and complexity of clinical decisions may also contribute to burnout. AI can ease this as a decision aid using data analytics and predictive modeling. Chatbots, virtual assistants, and telehealth platforms enable better interaction with healthcare workers and patients. These AI-driven technologies may improve efficiency and support healthcare professionals, contributing to their well-being and combating burnout (Akinrinmade 2023, Laker 2023, Gandhi 2023).

The Perception of AI-based Solutions Today

In the context of all this, it is very important how patients relate to AI-based health solutions. Our latest population survey (2024) indicated that nearly half of the internet using adult population has heard of artificial intelligence-assisted diagnostic tools (44.7 percent), drug development potential (44.7 percent), symptom detection and risk assessment methods (44.0 percent). However, only a small percentage indicated that they would like their doctor to use such tools. 37 percent of respondents said they would like their doctor to use AI in diagnosis, 33 percent said the same for drug development and 33.7 percent for risk analysis. The lowest awareness (30.2 percent) of mental health options (e.g. chatbots) and the rejection of this technology is also the most marked (only 18.6 percent of respondents would like their doctor to use it).

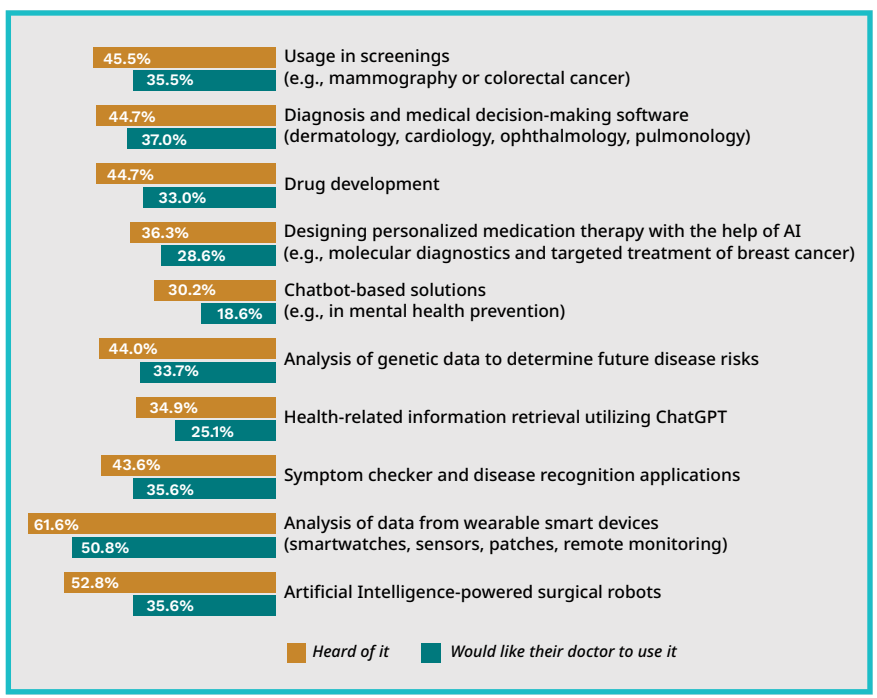

Figure 1: Knowledge of AI-based solutions

The Success of AI Depends on the Human Factor

According to a December 2022 Pew Internet Research study, 6 out of 10 Americans currently would not feel comfortable if their healthcare provider relied on AI-based solutions. Only 38% of the nearly 11,000 participants believed that the implementation of artificial intelligence would lead to better treatment outcomes. While AI-based solutions clearly enhance patient safety, 57% of respondents felt that they undermine the doctor-patient relationship. Similarly, our studies suggest that young people, highly educated individuals, and primarily men see greater potential in the use of AI in healthcare. However, nearly three-quarters of the total respondent population believe that the adaptation to AI is too rapid and does not fully consider the potential risks.

How Do Patients See the Role of AI-based Medical Solutions?

This section is based on the work of Eszter Sztanyi's Students' Scientific Association research.

We conducted an online survey between November 2023 and February 2024, where we examined the attitude of Hungarian university students to artificial intelligence. (n=133).

The largest number of respondents (37% and 36%) had heard of the use of AI in radiology and surgery, but the same number indicated that they had not heard of it in any field (also 37%).

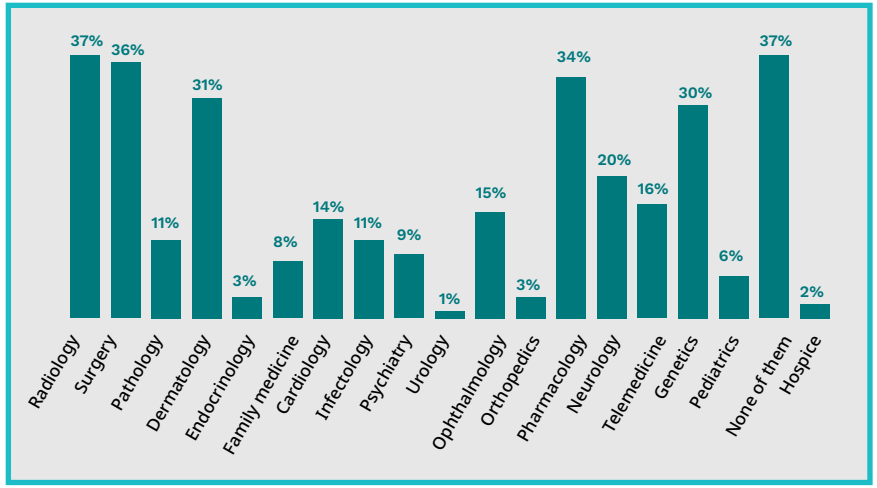

Figure 2: In which of the following healthcare fields have you heard of the use of AI?

Most of the respondents (43%) marked psychiatry as the medical field in which they could least imagine the use of artificial intelligence. This is because they consider AI probabilistic, impersonal, and less empathetic than a doctor.

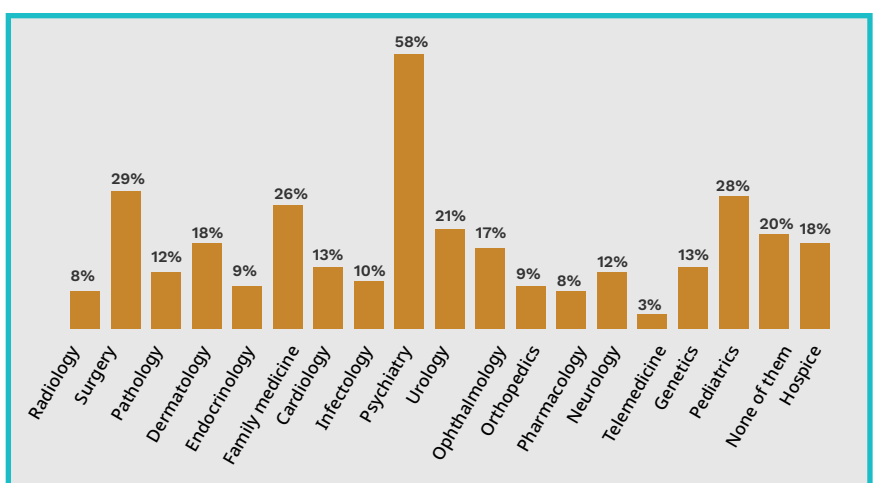

Figure 3: In which field could you least imagine using AI?

Most students have heard of the use of AI in healthcare in connection with smart devices, applications, and online appointment booking systems. These were followed by data management, research, and then the evaluation of the histological samples.

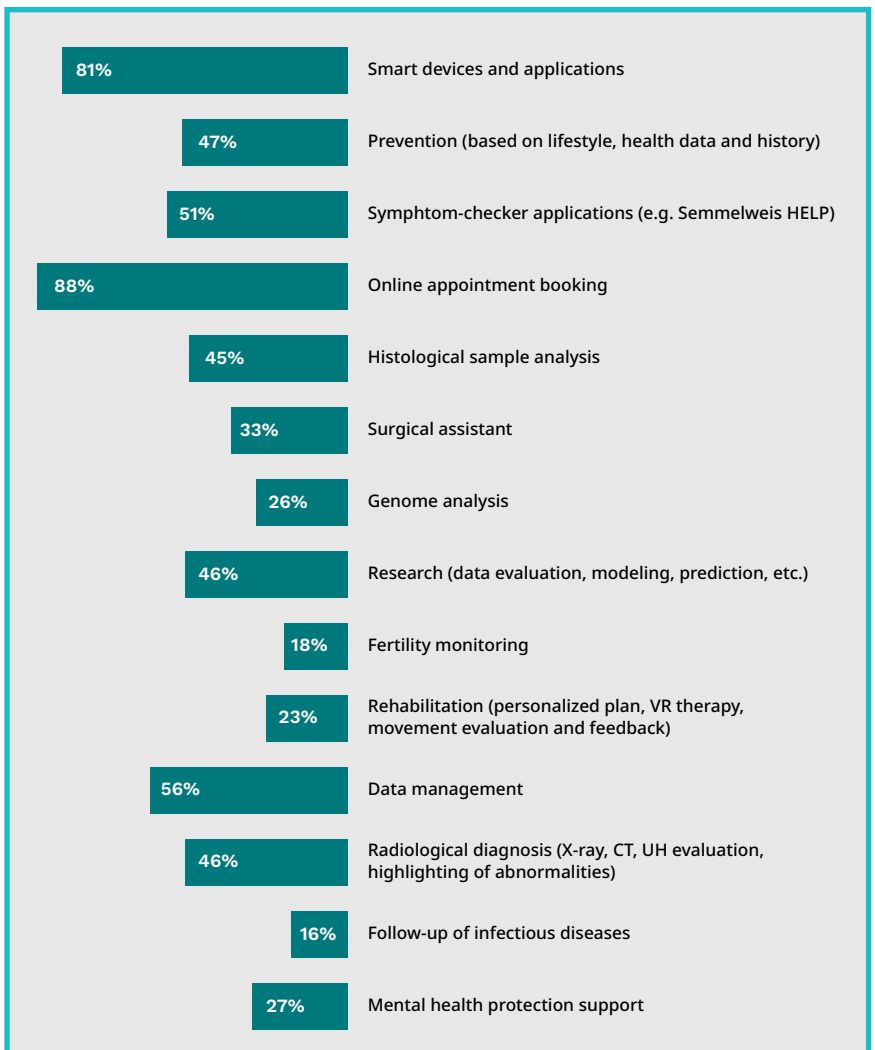

Figure 4: What healthcare uses of AI have you heard of?

According to the respondents, AI could not surpass doctors mostly in terms of personality and empathy, communication, and critical decision-making.

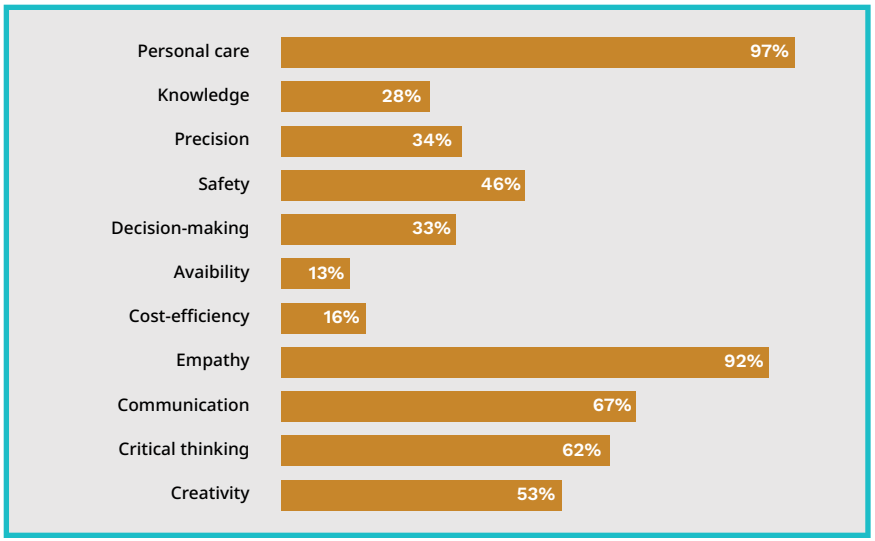

Figure 5: In which of the following do you think AI would not be able to outperform a doctor?

According to those interviewed, AI would best help doctors' work by reducing administrative burdens (103 answers). This is followed by assistance in evaluating findings, automation, and overcoming language barriers.

The respondents could choose the following five questions on a scale of 1-5, where 1 indicated disagreement and five indicated agreement.

According to the respondents, artificial intelligence would influence the accuracy of diagnoses in a more positive direction (average 3.27, but most were neutral). In addition, they believed that the use of AI would have a more positive influence on the outcome of the treatments (average 3.34).

In Ayers et al., respondents had to evaluate the answers to their questions, which were partly answered by a doctor and an AI chatbot (Ayers 2023). The results highlight the potential of AI chatbots to deliver high-quality responses and effectively meet

patients' needs. The preference for chatbot responses over physician responses in 78.6% of cases suggests that AI chatbots can offer valuable support and information to patients. The finding that physician responses were significantly shorter than chatbot responses may indicate a difference in communication style or availability of time for interaction. Regarding quality compared to physician responses, chatbots scored a significantly higher rating. AI chatbots can leverage medical knowledge and data to provide evidence-based information and support.

Moreover, chatbot responses were rated significantly more empathetic. In their interactions with patients, they used language that acknowledged and validated patients' emotions, expressing understanding of their concerns. Factors such as time constraints, workload, and communication style may influence the expression of empathy in physician-patient interactions, while AI chatbots can dedicate uninterrupted attention to patients.

As doctors, they would instead use AI less in their everyday lives (average 2.86) or think that its use would harm doctor-patient relationships (average 2.6) and that patients would not support the introduction of artificial intelligence in healthcare either (average 2.4; here, only 14% chose the positive direction).

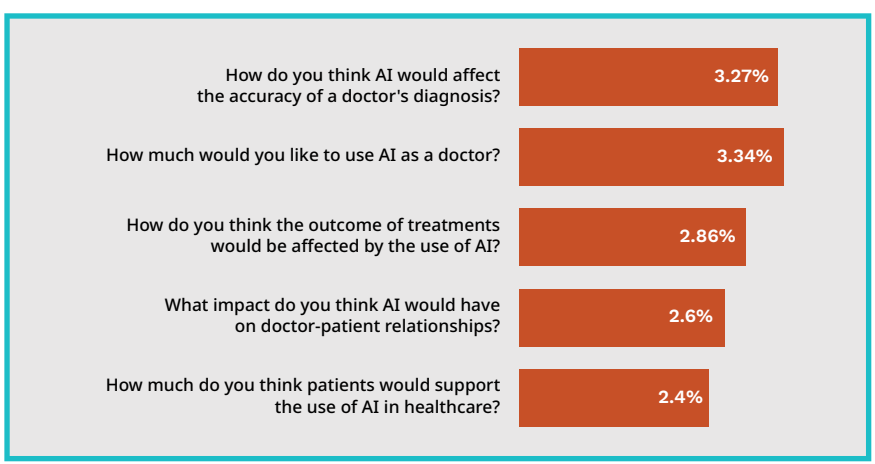

Figure 6: Patient perspectives of AI in healthcare: impacts on diagnostic accuracy, treatment outcomes, doctor-patient relationships, and patient acceptance

According to the respondents, the most significant advantage for patients is 0-24 availability and the fact that there would likely be a shorter waiting list. This was followed by overcoming language barriers.

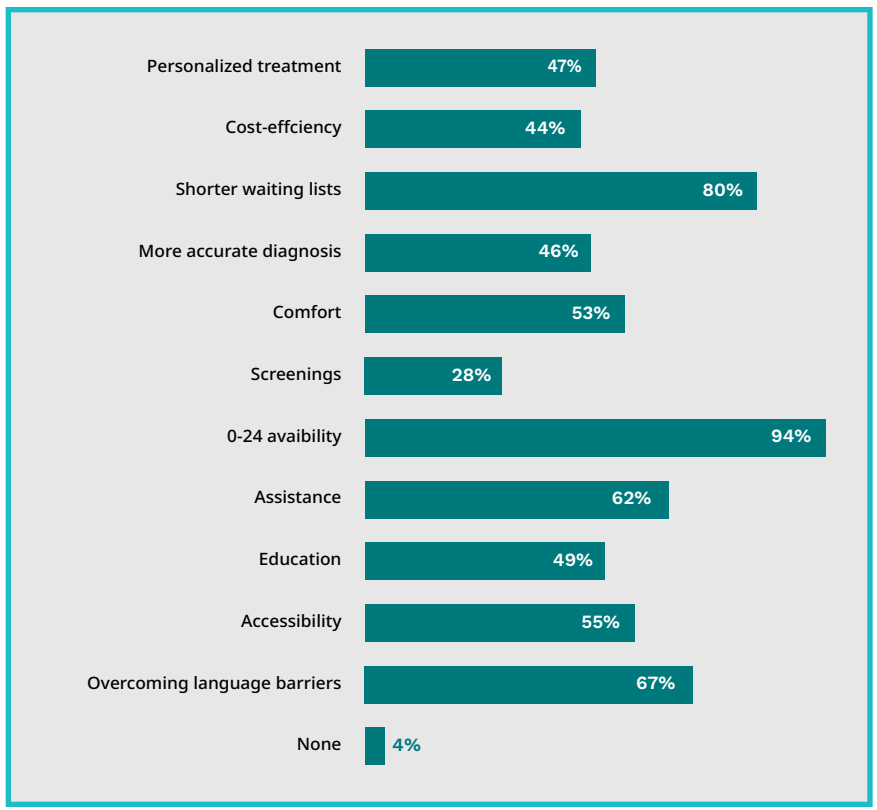

Figure 7: How do you think the use of AI in healthcare would benefit patients?

Most people choose lack of empathy, mistrust, and ethical problems as disadvantages. Generational differences follow, meaning the elderly are less open to AI and more against its use.

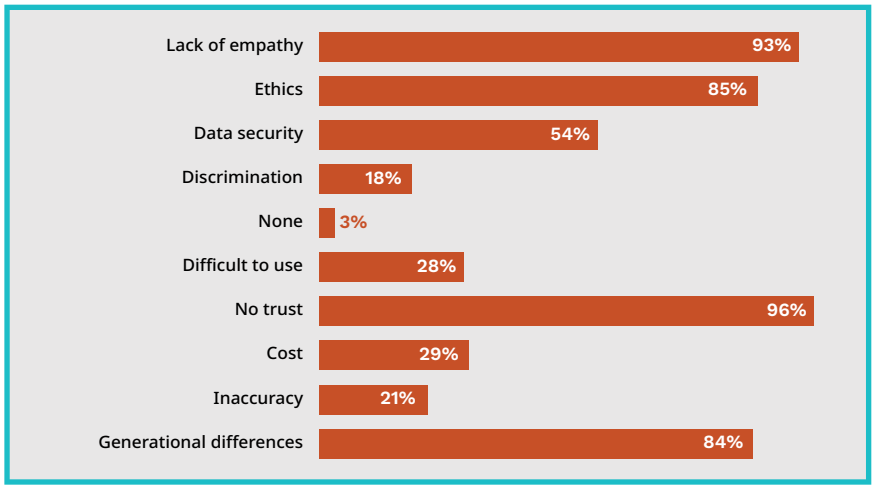

Figure 8: What do you think would be the disadvantages of using AI in healthcare?

People's attitudes, followed by fear of change and generational differences, were considered the biggest obstacle to introducing artificial intelligence in medicine.

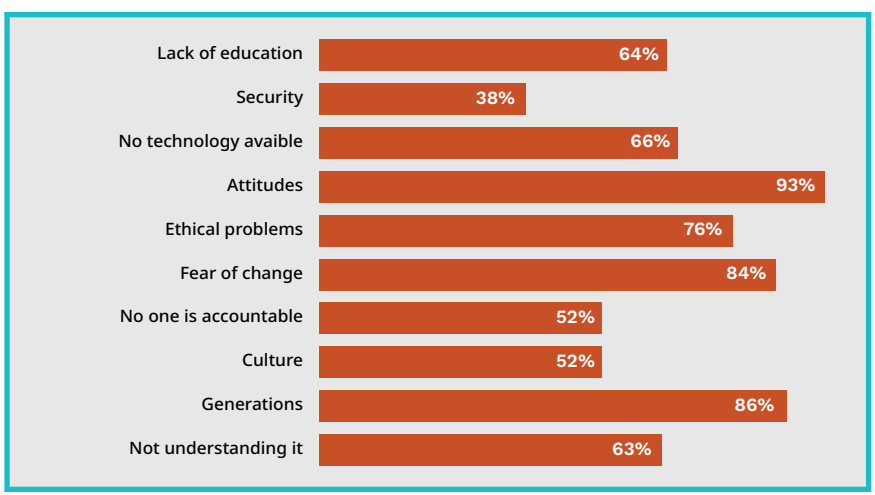

Figure 9: What do you think would be the disadvantages of using AI in healthcare?

How Will AI-based Solutions Transform the Doctor-Patient Relationship?

As medical sociologists, one of our primary research questions is how the doctor-patient relationship is evolving in the 21st century. AI-based solutions are expected to enhance the efficiency, personalization, and accessibility of healthcare, while also challenging the traditional dynamics between doctors and patients.

AI has the potential to significantly empower patients by providing them with knowledge and insights that were once the exclusive domain of healthcare professionals. This shift could enable patients to take more control over their health decisions, fostering greater autonomy. Furthermore, as AI takes on more routine tasks, healthcare providers may need to redefine their roles, focusing more on emotional support, counselling, and complex decision-making - areas where the human touch is irreplaceable.

In a 2021 article, "Moore's Law for Everything" OpenAI CEO Sam Altman predicted that within five years, AI programs capable of reasoning would be able to read legal documents and offer medical advice. This prediction seems to be coming to fruition. For instance, in a recent experiment, Scott Gottlieb, the former U.S. Commissioner of the FDA, tested five leading large language models (LLMs) on the challenging third stage of the U.S. Medical Licensing Examination (USMLE). Among them, OpenAI's ChatGPT-4 stood out, answering 49 out of 50 questions correctly and achieving a 98% score.

These advancements indicate that AI tools could soon act as trusted "team members" in healthcare, collaborating with doctors, nurses, and other providers to improve patient outcomes. However, integrating AI into healthcare will require careful oversight to ensure that these tools complement rather than replace human expertise. The key to this transformation's success will be maintaining the human elements of care that are vital to patient well-being, while harnessing the benefits that AI offers.

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I am a dentist. My mission is to advance public health practices through innovative research and effective education, ultimately enhancing oral health on a broader scale.

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