Digital Health and Social Inequalities: How to Include Vulnerable Groups, especially People Experiencing Homelessness, in Digital Care?

Ph.D. thesis

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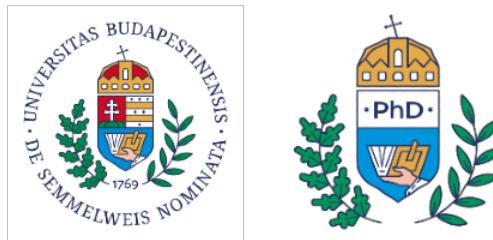
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Budapest, 2025

1. Introduction

1.1. A Digital and Cultural-Social Revolution in Healthcare

Technology has profoundly shaped the world, leading to the rise of countless innovations. Among these, the Internet, smartphones, and generative artificial intelligence have been pivotal in transforming societies, particularly in healthcare. The Internet has democratized access to knowledge. Smartphones, emerging with the iPhone in 2007, brought this accessibility into a compact, user-friendly form. The latest breakthrough, generative AI, notably ChatGPT, has blurred the lines between human and machine intelligence, offering new ways to process and generate medical knowledge.

The rise of digital health technologies has significantly altered healthcare delivery. Initially, eHealth focused on using IT solutions to streamline processes such as electronic health records (EHRs). With the proliferation of mobile devices, mHealth emerged, enabling remote monitoring and self-care. More recently, the explosion of big data and machine learning has further expanded the digital health landscape. Today, digital health serves as an umbrella term encompassing eHealth, mHealth, health IT, and innovations such as wearables, enhancing health monitoring and predictive analytics.
Beyond technological advancements, healthcare's digital transformation has fundamentally shifted social interactions. Medical professionals have transitioned from paper-based records to digital systems, improving efficiency, reducing errors, and facilitating evidence-based decision-making.

Digitalization has also empowered patients, leading to the emergence of e-patients—individuals who actively participate in their healthcare journey through digital tools. Coined by Thomas Ferguson, the term "e-patient" signifies individuals who are electronically connected, equipped, enabled, empowered, engaged, and expert in managing their health. These patients take initiative in their treatment, using digital tools to track health data and make informed decisions.

1.2.   Digital Health and its Global Trends

The evolution of digital health is more than just technological advancement: it represents a broader cultural and social transformation in healthcare. Successful implementation requires adaptation by both patients and providers, shifting the definition of digital health beyond technology alone. Instead, it is understood as the application of digital tools to improve health outcomes and patient care. A review of 95 definitions highlights that digital health enhances individual and population well-being through the intelligent use of clinical and genetic data. However, for digital health to reach its full potential, accessibility and usability must be prioritized, particularly for underserved populations.

The COVID-19 pandemic provided an unexpected catalyst for digital health adoption worldwide. With lockdowns and social distancing in place, what was once considered an option became a necessity. Telemedicine, in particular, saw an unprecedented surge. In Belgium, for example, there were zero teleconsultations at the beginning of 2020, but by March of the same year, the number skyrocketed to over 1.2 million. Similar trends emerged in Norway, England, and the U.S., where nearly half of all medical visits were conducted remotely during the peak of the pandemic. By 2021, the number of teleconsultations across OECD countries had more than doubled compared to pre-pandemic levels.

Despite this surge, disparities remain. Wealthier countries with stronger healthcare infrastructure embraced digital health more rapidly, while lower-income regions lagged behind. This "digital health divide" raises critical questions about whether technology can help reduce health inequalities or inadvertently widen them.

1.3.   Digital Health in Hungary

In Hungary, digital health adoption was limited before the pandemic. Rapid policy shifts led to significant systemic changes, however, cultural adaptation has been slower. The Digital Economy and Society Development Index 2022 ranked Hungary 22nd among 27 EU nations,

with only 49 percent of the population possessing basic digital skills. While the country exceeds the EU average in broadband and 5G infrastructure, digital literacy remains a challenge.

A 2021 national survey by Semmelweis University's Digital Health Working Group (DHWG) found that 81 percent of Hungarians used the Internet, and 71 percent searched for health-related information online. E-prescriptions (92.6 percent) and online appointment booking (85.2 percent) became widely used, largely due to pandemic restrictions. However, adoption varied by age, education, and gender, with younger, more educated women being the most engaged users.

A follow-up survey in 2024 revealed a growing shift towards digital health. Internet searches for health-related topics rose to 91 percent, with websites remaining the primary source of information. Nearly half of Hungarian patients now use smart devices or sensors for health management, and one-third have a health-related app on their smartphone. However, telemedicine remains underutilized, with only 14 percent regularly engaging in remote care. These trends indicate that digital health, as well as the concept of e-patients is becoming increasingly prevalent in Hungary, however they may be less accessible and effective for individuals and groups of different socioeconomic status.

1.4.   The Digital Health Paradox

While digital health solutions are increasingly accessible to the average Hungarian patient, health and social inequalities may significantly impact their adoption. Social determinants of health—factors such as economic status, housing, and education—can contribute to negative health outcomes, with an estimated 15 percent of premature deaths linked to these determinants. The WHO defines them as the broader social and economic forces shaping people's living conditions, which influence health disparities.

Recent research highlights how factors like poverty, food insecurity, and discrimination can lead to chronic stress, increasing the risk of conditions such as cardiovascular disease, diabetes, and cancer.

Digital literacy and internet access have been termed "super social determinants of health" since they influence all other health-related factors. However, reliance on digital tools may unintentionally widen existing disparities, as individuals lacking digital skills or connectivity struggle to benefit from digital health innovations.

Although frameworks like the WHO Global Strategy on Digital Health emphasize equitable and inclusive digital solutions, certain vulnerable populations—such as the elderly, people in rural areas, or those with chronic conditions—risk being left behind. This phenomenon, known as the digital health paradox, highlights the problem that those who would benefit from digital health technologies the most, have less access to them as the average population.

1.5. Homelessness, health, and digital inclusion

Homelessness presents a complex set of social, economic, and health challenges, leaving individuals at a severe disadvantage in terms of healthcare access, health literacy, and overall well-being. Defined by unstable or inadequate housing, homelessness is a growing issue across Europe, including Hungary, though official data remains scarce. As a definition of people experiencing homelessness, in the present thesis, which specifically deals this vulnerable population, we categorize and define "homeless" or "homelessness" to include every individual who has 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.

In terms of homelessness and health, research consistently links homelessness to significantly worse health outcomes, including higher rates of infectious diseases, chronic conditions, and mental health disorders. Life expectancy among homeless individuals is considerably lower than the general population, with mortality rates up to 12 times higher for women and eight times higher for men. Barriers to healthcare—such as lack of insurance, stigma, rigid

bureaucracy, and competing survival needs—further contribute to poor health outcomes and inadequate treatment.

People experiencing homelessness also face significant barriers to digital access, limiting their ability to benefit from digital health solutions. Studies show that homeless populations are less likely to own smartphones or have reliable internet access compared to low-income housed individuals. However, research indicates an interest in digital health tools, such as appointment reminders or certain apps, which indicates that, despite existing barriers, digital health interventions could provide meaningful benefits if adapted to meet the unique needs of homeless individuals.

1.6.   The Research Agenda of the DHWG

As the above literature review highlights, people experiencing homelessness face worse health outcomes and a shorter life expectancy, compounded by limited access to digital health tools and the Internet. This makes them a key example of the digital health paradox. While much research has been conducted on the health status of homeless populations in English-speaking countries like Canada, the UK, and the US, there is significantly less knowledge about their access to digital health tools, digital health literacy, attitudes toward digital technologies, or the specific subgroups within homeless populations in Central and Eastern Europe, particularly in Hungary.

To address this gap, the DHWG and the Hungarian Charity Service of the Order of Malta (HCSOM) have launched a comprehensive research agenda to explore the relationship between digital health and homeless populations in Hungary. This thesis fits into this large-scale effort.

Previous research has examined the attitudes of homeless individuals in Budapest toward telecare services, finding that they can have trust in telemedicine as much as patients in general healthcare, with trust in the broader healthcare system being a key factor for them. Building on this, a pilot project was initiated to assess the feasibility of telecare for

homeless populations. 75 individuals participated in the project, engaging in six biweekly online consultations with social workers serving as telemedical assistants. The study achieved a 92.2 percent completion rate, with 73.3 percent attending all sessions. Both patients and physicians reported high levels of satisfaction, and physicians noted that therapy changes were made during the sessions, indicating medically meaningful interactions. The study suggests that telehealth services, supported by shelter infrastructure and on-site assistance, can improve care continuity and reduce digital exclusion for homeless individuals.

2. Objectives

The general aim of this thesis was to uncover how the relationship between digital health and people experiencing homelessness in Budapest, Hungary can be grasped to clearly see the opportunities and barriers that present themselves for this population, and based on these findings, to offer recommendations so that people experiencing homelessness could reap the benefits of the digitalization of health (e.g. better access to the healthcare system in general, and better patient outcomes in particular).

Specifically, this thesis sought to address the following, building on the research agenda and previous results of the DHWG:

(1) Firstly, we had the objective to map out how people experiencing homelessness in Hungary, especially Budapest, use digital tools, and how they utilize such devices and services for health-related reasons;

(2) Secondly, we aimed to find clearly delimitable variables, such as age, education, institutional and social services environment, or any other demographic data that can be associated with the use of digital tools for health-related reasons.

(3) Thirdly, we wanted to examine whether a group of digitally engaged people experiencing homelessness exists who have access to digital tools and services despite all the barriers in their environment and who use their tools for health-related purposes. If there is such a group, we wanted to investigate

their specific characteristics to see whether they have any specific characteristic or behavioral trait that would allow them to invite their peers to participate in the digital health ecosystem.

Based on the literature, the specific hypotheses were as follows:

(1) Due to the digital health paradox, people experiencing homelessness have less access to mobile phones, smartphones, the Internet, and Internet-based products and services than the general population in Hungary.

(2) Building on the first assumption, people experiencing homelessness in Hungary use digital tools for health-related reasons less than the general population.

(3) Structural, institutional-level, and individual-level barriers and enablers of digital tool usage for health-related reasons can be identified.

(4) There is a small group of people experiencing homelessness, who exhibit the characteristics of digitally engaged persons.

3. Methods

To achieve the objectives of this thesis, a two-tier research agenda was adopted, with a wider-scale quantitative analysis and a narrower-scale, in-depth qualitative analysis building on each other and complementing their findings.

3.1. Methodology for the Quantitative Analysis

We conducted a face-to-face survey with the help of social workers in 28 institutions of HCSOM offering health and social services to people experiencing homelessness. As inclusion criteria, we welcomed clients who were in contact with the HCSOM social care. We developed a questionnaire about health-related knowledge and general literacy skills, access to digital tools and the Internet, and health-related digital tool and Internet use.

Overall, with the help of the social workers, we surveyed 662 people in Budapest, Hungary, between April 19, 2021, and August 11, 2021.

3.1.1. Statistical methods applied

We performed a descriptive analysis of the survey results (frequencies, averages, percentage distributions) to examine the first and second hypotheses. For certain questions, we used the Hungarian representative survey sample of the DHWG from 2021 as a reference group.

To examine the third hypothesis, the use of digital tools and its various correlates (demographic variables and variables related to access to health services) were compared with a single variable analysis using the Pearson Chi-square test, with a significance level of $P<.05$.

As binary comparisons proved to be incomplete, a multivariate analysis, a binary logistic regression model was used specifically for the question "Have you ever used the Internet for health reasons?" Beyond this dependent variable, control variables such as gender, type of institution and social service, level of education, age, frequency of medical visits, and prevalence of chronic illness were used. Independent variables affecting the dependent variables were selected using enter regression. The significance of the regression coefficients of the given variables was described using the P value of the Wald. Variables with $P<.05$ were retained in the final model.

For examining the fourth hypothesis, whether a digitally engaged group of people experiencing homelessness exists, we created a filtering methodology in the following order: we selected participants who responded that
1) they used the internet at least every second week,
2) they had smartphone ownership with either a data contract, pay-as-you-go service, or free Wi-Fi or computer or tablet ownership,
3) they were average or more competent internet users,
4) they had used the internet for health-related reasons before.

We also considered filtering the subpopulation based on the question "Have you ever used any health-related mobile application?" However, as only 18.5 percent (277/1500) in the reference group responded positively to this question, we expected a significantly lower number in the homeless population, bordering on analyzability.

3.2. Methodology for the Qualitative Analysis

A separate qualitative analysis was performed to continue the examination of the fourth hypothesis, mapping out the characteristics and behavioral specificity of a digitally engaged subgroup of people experiencing homelessness. The methodology for this research agenda is based on the *consolidated criteria for reporting qualitative research* (COREQ) checklist and the methodological framework of a previous DHWG study.

Due to the specificity of the sample and with an assumed limited prevalence in the overall population, purposive sampling was used to select the participants for the semi-structured interviews. Purposive sampling was based on the following criteria, mirroring the filtering methodology of the quantitative analysis:

1) the respondent is registered in the social care system of HCSOM,
2) uses the Internet every second week or more frequently,
3) accesses the Internet with their own smartphone, computer, tablet, or another device with a data contract, pay-as-you-go service, or free Wi-Fi,
4) rates themselves as average or more competent Internet user,
5) had used the Internet for health-related reasons before.

Although the sampling criteria of the qualitative research and the filtering criteria for the quantitative analysis match, the latter was performed as anonymous data collection, and this purposive sampling did not use the previous data pool as a starting point.

Altogether twelve interviews were conducted but only ten were included in the final analysis, as two interviews did not contain any reference to digital health usage. Social workers contacted four shelters run by HCSOM or their partner institutions. Based on the recommendations of the social workers, one-on-one, semi-structured interviews were conducted between 18 August and 27 October 2022. We conducted the interviews in Hungarian. The conversations were audio recorded in person, with an average interview length of 30 minutes.

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3.1.2. Thematic analysis as an Analytical and Theoretical Framework

We used thematic analysis outlined by Braun & Clarke, 2006 as our analytical and theoretical framework. In coding, we followed the 'theoretical' technique in an essentialist or realist method, driven by the analytic interest to report on study participants' experiences and realities. In coding, we followed the deductive technique, i.e. we worked with predetermined assumptions and themes, which followed the interview guide.

The theoretical thematic approach was used to analyze the data and identify patterns of themes based on the checklist elaborated by Braun & Clarke, 2006: (1) familiarizing ourselves with the content of the data, taking notes and coming up with 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 our results. The final thematic map was then laid out with participants' anonymized quotes supporting the results.

4. Results

4.1. Results of the Quantitative Analysis

4.1.1. Demographics

All in all, 662 adults responded to our survey. 71.2 percent were men, and 38.8 percent represented the age group of >60 years, whereas participants aged 18 to 44 years accounted for only 25.9 percent. The mean age was 53.9 years with an SD of 13.08 years. The majority, 70.7 percent, considered themselves homeless, whereas 25.8 percent did not. A total of 66.6 percent of respondents indicated how long they had been experiencing homelessness: 21.6 percent had been homeless for 1 to 5 years, 16.5 percent for 5 to 10 years, and 28.5 percent for >10 years, with a mean of 11.35 years and an SD of 9.27 years. Most of the respondents had only completed primary education (38.1 percent) or vocational training (35 percent), whereas 20.4 percent of

the respondents had graduated high school, and 4.5 percent said they had completed their college or university education.

4.1.2. Access to and use of digital tools and services

When surveyed about the sources they used for gathering medical information, 20.5 percent of respondents reported searching online, which ranked third after consulting their primary care physician (53.1 percent) and seeking guidance from social workers within social institutions (39.2 percent). Notably, respondents were more likely to use the Internet for medical information than to consult family members or friends (16.3 percent).

For the multiple-choice question "How do you access the Internet at the moment?", 17.8 percent indicated they had their own smartphone with a data contract, while 18.1 percent used a pay-as-you-go service for their smartphone. Additionally, 21.4 percent accessed the Internet via free Wi-Fi hotspots using their own smartphones, and 24.7 percent utilized publicly available PCs in social institutions or shelters. Only 15 respondents (2.7 percent) owned a personal computer, while 84 respondents (15.2 percent) selected "Other," which included using another person's device, visiting internet cafés, or owning a tablet. Comparatively, 81.3 percent of the reference group (1220/1500) reported frequent Internet use, whereas in the homeless group, 67.2 percent stated they had used the Internet for any purpose.

Among the respondents who had used the Internet, 52.9 percent reported usage within the past six months. However, daily Internet use was significantly lower, at 34.6 percent, with an additional 10.6 percent indicating usage multiple times per week.

Among the respondents experiencing homelessness 69.6 percent reported owning a mobile phone, with 39.9 percent indicating that their phone had smartphone functions. Additionally, 11.2 percent of this group reported having used at least one mobile health app, compared to 18.5 percent in the reference group. Those who used mHealth apps cited functions such as step counting, accessing emergency assistance, obtaining medical information, and sharing health data.

When asked "Have you ever used the Internet for health reasons?", we found that 34.6 percent of people experiencing homelessness reported having done so. In comparison, the reference group showed higher usage rates, with 10.7 percent using the Internet daily, 18.4 percent weekly, 18.2 percent monthly, and 24 percent less frequently, representing 71.3 percent (of the general sample. This indicates that the general population used the Internet for health purposes more than twice as often as the group of people experiencing homelessness. Chi-square tests revealed significant associations with gender (P=.007), age (P<.001), and frequency of medical visits (P=.01), indicating that younger female respondents and those who visited a physician more frequently were more likely to use the internet for health-related purposes.

4.1.3. Enabling and hindering factors

In response to the multiple-choice question, "What barriers, if any, restrict your Internet use?", 30.8 percent of respondents indicated that they faced no hindrances. However, 15.2 percent reported insufficient free Wi-Fi hotspots as a barrier, and 6.7 percent noted owning a smartphone but lacking a data contract or pay-as-you-go service. Additionally, 7.6 percent stated that although they had Internet access, they did not know how to use it. A lack of smartphone ownership was reported by 21.4 percent, while 8.8 percent (mentioned the scarcity of publicly accessible PCs, such as those in social service institutions. Lastly, 9.4 percent indicated they had no access to the Internet anywhere.

In response to the question "What would help you use the Internet more?", 24.2 percent of respondents expressed a desire to have a smartphone. Another 18.4 percent sought better access, indicating they owned a smartphone but lacked an Internet connection option. Additionally, 9.4 percent reported needing better access to publicly accessible PCs, as the availability of these was limited in the shelters. Furthermore, 22.6 percent mentioned that gaining more knowledge about the Internet would help, as they did not know how to use it and would benefit from assistance. For 25.4 percent, the question was not relevant, as they already used the internet as much as they wanted.

4.1.4.   Multivariate analysis

To further explore which demographic or health status variables influenced health-related Internet use, a binary logistic regression model was applied. The dependent variable was health-related Internet use, and the model included gender (1=woman, 2=man), age (as a continuous variable), type of institution and social service (6 categories), education level (4 categories), frequency of medical visits, and the prevalence of chronic conditions. The logistic regression model was found to be significant (Nagelkerke R^2 = 0.154). After controlling for the variables, the analysis revealed that health-related internet use was strongly influenced by age, with a statistically significant association with gender, education level, and the prevalence of chronic conditions ($P<.05$). To break that result down, younger homeless women without chronic conditions were more likely to use the Internet for health-related purposes.

4.1.5.   Digitally engaged group of people experiencing homelessness

During our analysis, we found a specific subpopulation in the sample that we labeled a "digitally engaged group of people experiencing homelessness." The members of this group were unique in that they did not need further digital inclusion. This group was selected for further analysis based on the criteria specified in the Methodology section. The below chart shows the selection process and their frequency in the sample.

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Starting point: total number of respondents: 662/100%
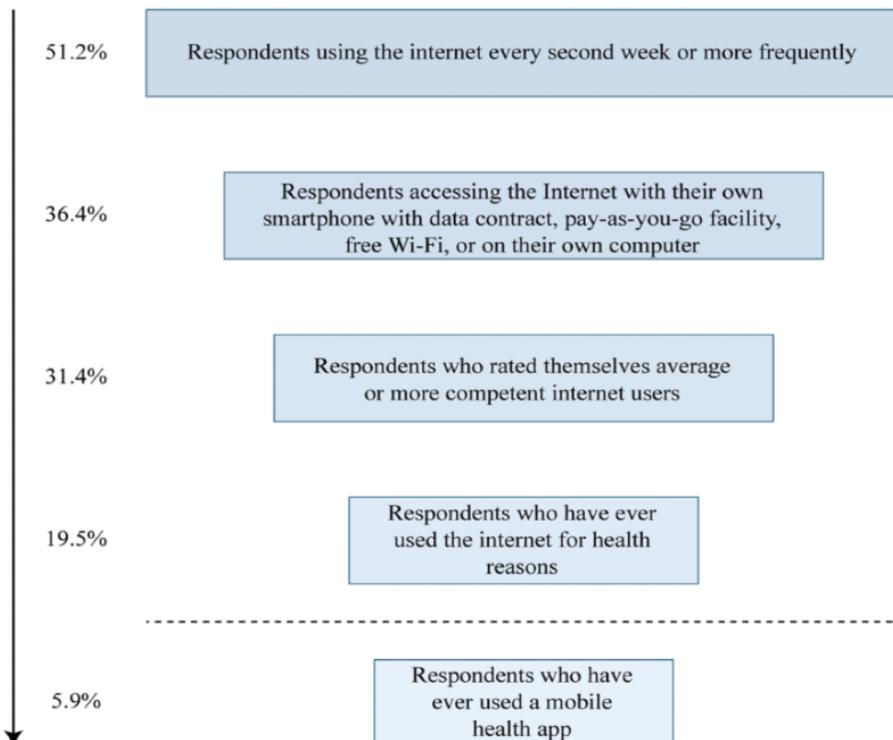
Figure 1. The Flowchart for Selecting Members of the Digitally Engaged Group. Source: Radó et al., 2022.

As shown on the flowchart, the broadly defined subgroup included 19.5 percent of the total group of people experiencing homelessness, with significantly more women (36.4 percent) than in the original population (28.8 percent). Chi-square test results were significant for the prevalence of chronic disease ($P=.047$); meaning that respondents with chronic diseases were more likely to frequently use the Internet for health-related reasons. Although the institutional setting was not an associative variable, temporary shelters (31 percent) and day and night shelters (21.7 percent and 17 percent, respectively) housed most respondents in the subpopulation (69.7 percent).

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4.2. Results of the Qualitative Analysis

The main results and the code tree of the thematic analysis of the semi-structured, in- depth interviews are shown below.
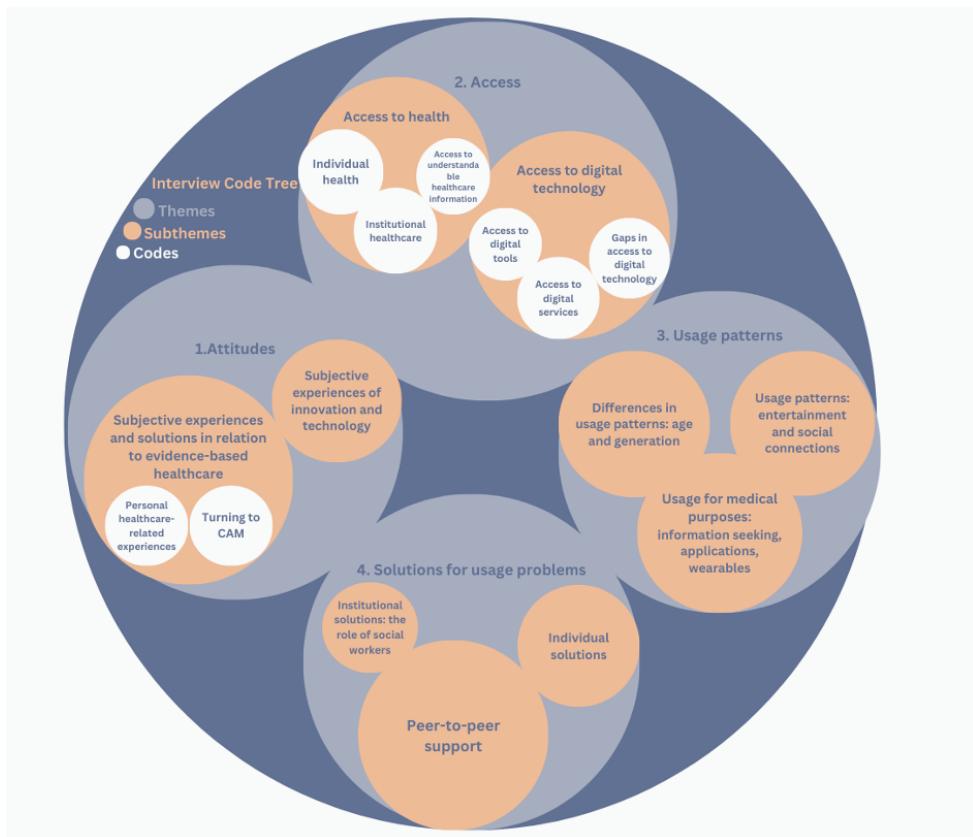

Figure 2. The Qualitative Interview Code Tree.

In terms of attitudes, one of the main findings was that in a minority of interviews (three interviews), participants mentioned using complementary and alternative medical (CAM) solutions, such as medicinal herbs or Chinese medicine, which they regarded as viable

alternatives to traditional Western medicine. Conversely, in two interviews, participants expressed a negative view of drugs and medicines, often discussed in the same context. These perspectives highlight the respondents' search for alternative solutions for their health issues. Some individuals felt that the mainstream healthcare system and conventional pharmaceuticals had failed to provide satisfactory solutions. As a result, they turned to medicinal herbs or other ingredients recommended by trusted sources or discovered through online research.

In terms of access to technology and access to health, the interviews underpinned the findings of the quantitative analysis. The overwhelming majority of interviewees reported using smartphones (seven interviews), while notebook usage was mentioned in one case and tablet usage in two cases. One participant also noted the use of a power bank to charge their device. A majority of the participants actively sought out free Wi-Fi options both within and outside shelters (six interviews). Subscription-based Internet access (three interviews) or pay-as-you-go services (five interviews) were less common due to affordability constraints. In some instances, interviewees (three interviews) visited cafés specifically to charge their phones or access the Internet. Interviewees highlighted challenges related to both the availability of devices and network coverage. Several participants emphasized the need to secure a device, such as a smartphone, or to explore ways to reduce the costs of subscriptions and pay-as-you-go plans. In isolated cases (one interview each), the idea of implementing smart benches in public spaces or providing free Wi-Fi on trams and buses in Budapest was suggested.

In terms of usage patterns, interviewees primarily used the Internet for entertainment and social connection. Activities such as watching movies, listening to music, reading e-books, and playing mobile games were commonly reported. Social media platforms were frequently mentioned, with Facebook being the most referenced. A minority of participants also used the Internet for purposes such as information gathering, reading the news, and conducting online banking. Several interviewees reported using the Internet to seek medical information. Common activities included researching

prescribed medications (five interviews), their active ingredients (four interviews), and alternatives such as medicinal herbs or foods (two interviews). A 30-something interviewee communicated with their doctors via email, researched their health conditions and prescribed medications online, and used a health app along with a step counter. Two other participants also used health apps, although one stopped using the step counter because they found it inaccurate.

In terms of solutions for usage problems, many interviewees reported that they offered assistance to fellow shelter residents who encountered difficulties with digital tools or Internet usage (six interviews). They helped peers with tasks such as SIM card registration, activating pay-as-you-go services, performing anti-virus operations on devices, troubleshooting issues with online platforms like Facebook and Messenger, and addressing questions related to online purchases. These issues were generally basic in nature, and most interviewees possessed the knowledge and skills to resolve them. This is one of the most important findings of the qualitative analysis as it shows that unintentional peer to peer support has a place in this population, and can be an untapped resource for further digital inclusion, as well as for digital literacy trainings.

5. Conclusions

When we examine our hypotheses, we can clearly state that

(1) (2) due to the digital health paradox, people experiencing homelessness have less access to mobile phones, smartphones, the Internet, and Internet-based products and services than the general population in Hungary. And building on the first statement, we can also say that people experiencing homelessness in Hungary use digital tools for health-related reasons less than the general population.

However, we can also state that there is considerable digital tool and Internet use in the population, so the idea of involving homeless populations in Hungary in the digital health ecosystem is a viable concept, especially if barriers to access are systematically reduced and the enablers of use are strengthened.

(2) Structural, institutional-level, and individual-level barriers and enablers of digital tool usage for health-related reasons can be identified. In the thesis, we offered policy recommendations to address these infrastructural needs, institutional-level or individual-level needs.

To mitigate the digital divide and make sure that vulnerable groups in societies, e.g. people experiencing homelessness, also have the chance to experience the benefits of digital health technologies, the "equitable, meaningful, and safe access to use, lead, and design of digital technologies, services, and associated opportunities for everyone, everywhere", would be the ideal state of play. This is how the UN defines digital inclusion, and it also refers to all the necessary activities that ensure equitable access to and use of information and communication technologies in general. These include (1) affordable broadband Internet service, (2) Internet-enabled devices, (3) access to digital literacy training, (4) quality technical support, and (5) applications and online content designed to enable and encourage self-sufficiency, participation, and collaboration.

(3) There is a small group of people experiencing homelessness, who exhibit the characteristics of digitally engaged persons. This subgroup in the population actively uses their devices for health-related purposes, and that performs peer to peer support when it comes to technological issues. Their presence might form a basis for any potential digital health literacy program in shelters, as they have the trust and technical knowledge that are the preconditions for the success of any such program within this vulnerable group.

6. Bibliography of the candidate's publications
Publications related to the thesis:

Radó N, Békási S, Győrffy Zs. Health Technology Access and Peer Support Among Digitally Engaged People Experiencing

Homelessness: Qualitative Study. JMIR Hum Factors 2024;11:e55415. doi: 10.2196/55415 (IF: 2,6)

Radó N, Girasek E, Békási S, Győrffy Z. Digital Technology Access and Health-Related Internet Use Among People Experiencing Homelessness in Hungary: Quantitative Survey. J Med Internet Res 2022;24(10):e38729. doi: 10.2196/38729 (IF: 7,4)

9.1. Publications not related to the thesis (∑IF: 15,136)

Győrffy Z, Döbrössy B, Radó N, Boros J, Békási S. State of vulnerable populations in the techquity framework in Hungary. Frontiers in Public Health. 2023 Jul 6;11:1215325. doi: 10.3389/fpubh.2023.1215325. PMID: 37483940; PMCID: PMC10357289. (IF: 3,0)

Győrffy, Z., Radó, N., Pölczman, L. et al. 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 (IF: 2,7)

Győrffy Z, Békási S, Döbrössy B, Bognár VK, Radó N, et al. (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 (IF: 3,7)

Győrffy Z, Radó N, Meskó B. Digitally engaged physicians about the digital health transition. PLoS ONE 15(9): e0238658. https://doi.org/10.1371/journal.pone.0238658 (IF: 3,240)

Meskó B, Radó N, Győrffy Z. Opinion leader empowered patients about the era of digital health: a qualitative study. BMJ Open 2019;9:e025267. DOI:10.1136/ bmjopen-2018-025267 (IF: 2,496)

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