THE USE OF E-HEALTH DURING THE COVID-19 PANDEMIC BY OLDER ADULTS IN POLAND

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Purpose: The aim of this research is to analyze the use of e-health and assess its usefulness to older adults in Poland during the COVID-19 pandemic. It was also important to identify potential socio-demographic and health factors that may influence the use of e-health by older people.

Design/methodology/approach: In this article the quantitative research method was used. A survey was conducted with 400 respondents. One-way ANOVA and chi-square ($\chi2$) test were used to analyze the relationship between e-health use and various socio-demographic characteristics of respondents.

Findings: The results show that several factors are associated with increased use of e-health services, including age, marital status, domicile, health, and education. Younger, married and better educated people, urban residents, and with better health are more likely to use various elements of e-health.

Research limitations/implications: The importance of e-health will grow as societies age and technology develops. In future research, it would be worthwhile to investigate problems in the practical application of telehealth that raise deep concerns among older people. The use of incentives could then be increased, increasing satisfaction with e-health systems.

Practical implications: Older adults should be considered the most important users of e-health, taking into account the fact that the way they use and perceive these systems is especially important for sustainable development.

Social implications: This finding should inspire policymakers, especially the Ministry of Health, to increase and expand the use of e-health systems by encouraging older patients with health problems, especially from rural areas, to use remote patient monitoring technologies and ICT devices to treat their diseases.

Originality/value: The use of e-health systems by older patients in Poland is on the whole inadequate. Most of these people have generally negative opinions and attitudes towards e-health services.

Keywords: e-health use; e-health usefulness, elderly; COVID-19.
Category of the paper: research paper.

1. Introduction

Electronic health (e-health) is one of the fastest-growing areas of healthcare in many countries, including Poland. Several factors contribute to this rapid increase, including an ageing population, patients' preference for care provided in their homes, and earlier discharges from intensive care units (Ma et al., 2022; Triantafillou et al., 2020). E-health systems are becoming increasingly popular as they allow them to maximise productivity and efficiency while reducing costs in home healthcare (Chae et al., 2001; Van Der Meij et al., 2016). The advantage of e-health is improving the availability and quality of healthcare between patients and healthcare providers and saving time. E-health breaks space-time constraints to deliver remote treatment and optimise the allocation of medical resources.

E-health is defined as the provision of any health service or information that involves the use of the Internet or other forms of information and communication (ICT) technologies (Alkawaldeh et al., 2023; Boogerd et al., 2015), including, for example, digital storage and transmission of medical records, consultations and medical training conducted via video conference (Ali et al., 2021).

Due to COVID-19, e-health has expanded to more patients to reduce unnecessary exposure and preserve personal protective equipment. Many organisations subsequently began to use the infrastructure to provide teleconsultations, including video teleconsultations, and to encourage patients to use mobile applications to monitor their health. An additional advantage of some applications of this type is that they take into account the user's perspective, using Human Centered Design (HCD) methodologies and collect data using various devices (e.g. data containing high-quality health information collected from various sources) (Park et al., 2022).

The literature emphasises that providing e-health services can particularly benefit older adults because they are more susceptible to chronic diseases. A rapidly ageing population entails a significant increase in the incidence of chronic diseases and their consequences, and thus, the need for increased care and well-being (Merrell, 2015). E-health could also prove helpful for people who have mobility problems and are more susceptible to infectious diseases such as COVID-19 (Jankowiak, Rój, 2023).

Based on the analysis of the literature on the subject (Bashshur et al., 2015; Chumbler et al., 2015; Lemay et al., 2013; Levine et al., 2014; Postma-Nilsenová et al., 2015), it can be concluded that the use of e-health systems exceeds the number of visits to the doctor's office due to diabetes, hypertension, pain, congestive heart failure, cancer treatment, stroke rehabilitation and dementia. Therefore, older adults have become one of the main target groups of telecare technologies. Telecare solutions provide new opportunities for diagnosis, treatment, education and rehabilitation, enabling monitoring of patients with many chronic diseases. They also reduce socio-economic disparities in care access and equalise patients' changes in urban and rural areas (Bujnowska-Fedak, Grata-Borkowska, 2015).

On the other hand, there is a widespread belief that older people cannot use advanced electronics and telecommunications due to their limited computer and technology skills (Merrell, 2015). It should be emphasised that older people could benefit much more from e-health if it were not for the fact that they often struggle with particularly high barriers to using new technologies (König et al., 2018; Poli et al., 2019).

The aim of this research is to analyse the use of e-health and assess its usefulness to older adults in Poland during the COVID-19 pandemic. It was also important to identify potential socio-demographic and health factors that may influence the use of e-health by older people.

Achieving the intended goal of the work requires answering three research questions:

1. To what extent have older adults used e-health systems during the COVID-19 pandemic?
2. How do older adults assess the usefulness of remote technologies in monitoring their health?
3. What socio-demographic factors predict the use of e-health among older people in Poland?

Research carried out so far has focused on the use and evaluation of e-health from the patients' perspective (Holtz, 2021; Isautier et al., 2020; Merrell, 2015; Powell et al., 2017), especially in terms of reliability (Lobacz et al., 2023; Zarate et al., 1997), cost-effectiveness (Doolittle et al., 1998), and patient satisfaction (Allen, Hayes, 2009; Mekhjian et al., 1999). However, such research has not been conducted in Poland and there is no detailed report on the use and experiences of e-health by older people. Moreover, to the authors' knowledge, no attempt has been made to empirically investigate the determinants of using specific e-health components among older adults. Previous studies have focused on the predictors of e-health adoption in general (Andrews et al., 2019; Jokisch et al., 2020; Menéndez Álvarez-Dardet et al., 2020). Among the telecare services aimed specifically at older adults, two main systems are in the lead: systems for remote monitoring of patients' health, including their vital signs such as heart rate, blood pressure, body temperature and glucose levels; support systems via ICT, e.g. teleconsultations, SMS reminders about appointments and prescribed medications (Barlow et al., 2007). It is therefore important to investigate the socio-demographic and health factors influencing older patients' use of these e-health components.

2. Materials and Methods

The survey regarding the use and perception of e-health systems by older people was conducted from September 13 to 27, 2021, i.e. during the COVID-19 pandemic, when the transition to remote medical care occurred. Survey research was carried out using a traditional form. The printed survey form was personally delivered to students of the University of the

Third Age and participants of Seniors' clubs in the Masovian Voivodeship (the voivodeship being the highest-level administrative division in Poland). Universities of the 3rd age are educational institutions for older adults. They are a form of activating seniors and create the opportunity to constantly expand their knowledge, make friends, and provide the opportunity to keep up their physical condition. Seniors' clubs, on the other hand, are facilities that are meeting places for older adults. These facilities do not provide treatment or care, but they focus on creating a friendly space for seniors where they can spend time together. Seniors' clubs often offer seniors a large selection of various activities tailored to each participant's interests. Available options include foreign language learning and computer workshops. When selecting the research sample, it was also assumed that students of the University of the Third Age have basic digital qualifications (they can use e-mail and an Internet search engine), which is reflected in the respondents' answers in this regard. Participants were informed that the survey was anonymous. The criteria for inclusion in the study were age over 60 and oral consent to participate in the study. No upper age limit was set. Patients could withdraw from the study any time or not answer all questions. A total of 550 surveys were submitted, of which 400 were returned. All the surveys received were filled out completely and correctly.

An original, structured survey questionnaire was used to conduct the survey. The survey contained questions grouped into two categories. The first concerned the use of IT systems and e-health. The second part concerned socio-demographic variables and the health status of older adults.

In the first part of the survey questionnaire, older adults were asked to answer survey questions regarding ICT use. The study used information related to ICT, such as access to ICT tools (e.g. computer, smartphone, RMP - remote patient monitoring devices) and the use of e-health services (electronic data exchange, teleconsultations, video advice, RMP). The variables for measuring access to ICT tools were binary variables that indicated whether the respondent used at least one type of ICT tool, including a computer and mobile phone, to access remote health services. Respondents were also asked to indicate specific tools for remote monitoring of the patient's health (RMP) that they used during the COVID-19 pandemic (e.g. thermometer, blood pressure monitor, heart rate monitor, telemedicine wristband, video monitoring, electronic camera, motion detectors, smart watches, activity band with geolocation). The level of use of E-Health systems in the era of the coronavirus pandemic was assessed on a five-point Likert scale ("very weak", "weak", "average", "good", "very good").

The second part of the questionnaire contained questions about the health status of older adults and key socio-demographic variables. The following explanatory variables were used in the study: age, education, and marital status. Respondents were also asked to self-assess their health on a five-point scale (very good, good, average, unsatisfactory, very unsatisfactory).

The relationship between e-health use and the studied socio-demographic variables was determined using the chi-square ($\chi2$) test and ANOVA analysis. Data were calculated and analysed using Statistica software (version 13.3).

3. Results

3.1. Socio-demographic and health characteristics of the respondents

The socio-demographic and health characteristics of the respondents are shown in Table 1.

Table 1.
*Socio-demographic and health characteristics of the respondents*

Variable		Total		Women			Men		
		Number of responses	%	Number of responses	%	% Women	Number of responses	%	% Men
Sex	Woman	231	57.75						
	Man	169	42.25						
The level of use of e-Health by older adults in Poland during COVID-19	Very good	58	14.50	33	8.25	14.29	25	6.25	14.79
	Good	36	9.00	16	4.00	6.93	20	5.00	11.83
	Average	141	35.25	85	21.25	36.80	56	14.00	33.14
	Weak	87	21.75	49	12.25	21.21	38	9.50	22.49
	Very weak	78	19.50	48	12.00	20.78	30	7.50	17.75
The health assessment	Very good	13	3.25	6	1.50	2.60	7	1.75	4.14
	Good	98	24.50	59	14.75	25.54	39	9.75	23.08
	Average	109	27.25	53	13.25	22.94	56	14.00	33.14
	Weak	63	15.75	48	12.00	20.78	15	3.75	8.88
	Very weak	117	29.25	65	16.25	28.14	52	13.00	30.77
Age	60-64	93	23.25	56	14.00	24.24	37	9.25	21.89
	65-69	106	26.50	58	14.50	25.11	48	12.00	28.40
	70-74	106	26.50	65	16.25	28.14	41	10.25	24.26
	75 and above	95	23.75	52	13.00	22.51	43	10.75	25.44
Marital status	Bachelor/single	40	10.00	21	5.25	9.09	19	4.75	11.24
	Married	189	47.25	111	27.75	48.05	78	19.50	46.15
	Widower/widower	122	30.50	70	17.50	30.30	52	13.00	30.77
	Divorced	49	12.25	29	7.25	12.55	20	5.00	11.83
Domicile	City	337	84.25	196	49.00	84.85	141	35.25	83.43
	Village	63	15.75	35	8.75	15.15	28	7.00	16.57
Education	Primary education	48	12.00	23	5.75	9.96	25	6.25	14.79
	Vocational education	90	22.50	49	12.25	21.21	41	10.25	24.26
	Secondary education	167	41.75	109	27.25	47.19	58	14.50	34.32
	Higher education	95	23.75	50	12.50	21.65	45	11.25	26.63
Using RMP devices	Yes	303	75.75	171	42.75	74.03	132	33.00	78.11
	No	97	24.25	60	15.00	25.97	37	9.25	21.89
Using smartphones	Yes	400	100	231	57.75	100	169	42.25	100
	No	0	0	0	0	0	0	0	0

A total of 400 respondents participated in the survey, 50.25% of them over 70. Women made up 57.75% of the respondents. Almost half of the respondents (47.25%) were married, 30.50% were widows/widowers and 12.25% were divorced. Regarding education, 12% of respondents had only completed primary school, 22.50% had completed vocational school,

41.75% had completed secondary school, and 23.75% had completed higher education. Most of the survey participants came from a city (84.25%). Almost half of the respondents (45%) described their health status as unsatisfactory or very unsatisfactory, while only 3.25% described their health status as very good. The level of e-health use by seniors is average. The largest group of respondents (35.25%) assessed using e-health at an average level.

3.2. The assessment of the usefulness of e-health technologies

The respondents were asked to rate e-health usefulness in medical care on a scale of 1 (Very weak) to 5 (Very good). The responses to this question are shown in Figure 1.
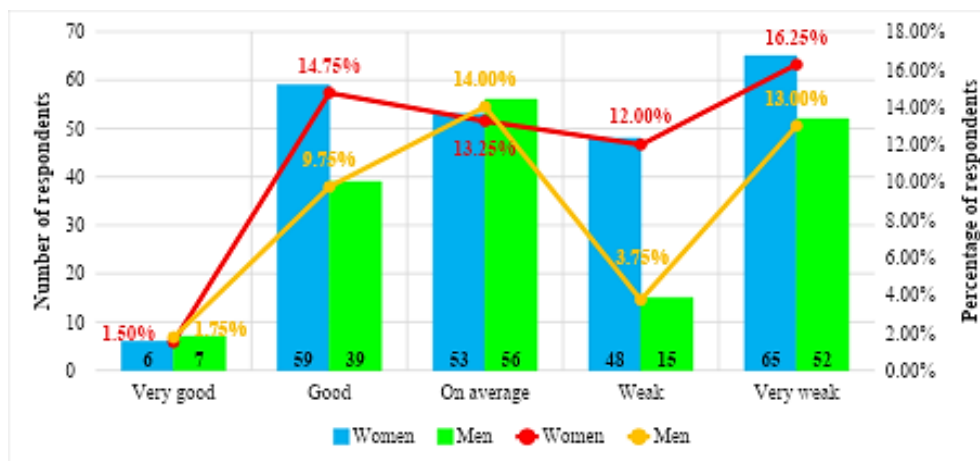
Figure 1. The assessment of the usefulness of e-health remote technologies by older adults.

The average rating of the usefulness of remote e-health technologies for seniors is 2.57. As many as 45% of respondents rate the usefulness of e-health systems as unsatisfactory or very unsatisfactory. Such a rating indicates moderately negative feelings of the surveyed older people towards the technology. This shows an overall low satisfaction, which may imply that the majority of surveyed older people are not fully satisfied with the available solutions. Additionally, this may highlight the need to improve and develop e-health technologies to make them much more responsive to the needs of older people. Current technologies may be unintuitive, too complicated or not adapted to their requirements. In addition, such a low rating may indicate the emergence of barriers to their use and the need for education in this area. It is possible that older people need education and support to understand and effectively use e-health technologies. Despite the low average rating, 27.75% of respondents rated the usability of e-health systems as good or very good. This means that a group of older people who saw the benefits and value of using these technologies were surveyed.

3.3. The relationship between respondent characteristics and e-health use

The statistical study investigated the existence of a relationship between the socio-demographic and health characteristics of older people and e-health use. The authors tested the existence of an association between items related to various elements of e-health systems and

a specific characteristic of seniors with a one-way ANOVA analysis of variance and a χ2 test, formulating the following hypotheses - null (H0) and alternative (H1):

- H0: The characteristics of seniors affect the e-health use,
- H1: The characteristics of seniors do not affect the e-health use.

All cases in which the existence of a relationship between the characteristics of older people and the individual level of use of e-health systems during COVID-19, i.e. cases in which the null hypothesis was rejected, and the p-value is less than 0.05, are presented in Table 2.

Table 2.
Relationship between e-health use and participant characteristics

Characteristics of older people	Anova			χ2 test		
	e-health use	F	p-value	χ2 test statistic	Number of degrees of freedom	p-value
The health assessment	Life-saving wristband	3.01	0.02	11.84	4	0.02
Gender	Teleconsultation	9.8	0.00	9.62	1	0.002
Age	RMP monitoring devices	6.9	0.00	19.88	3	0.0002
	Video consultation	3.46	0.02	10.22	3	0.02
	Electronic camera	3.82	0.01	11.26	3	0.01
	mHealth apps	2.78	0.04	8.24	3	0.04
	Life-saving wristband	3.40	0.02	10.04	3	0.02
Marital status	Teleconsultation	4.87	0.00	14.24	3	0.003
	Electronic data exchange	2.75	0.04		No dependencies	
	RMP devices	3.32	0.02	9.81	3	0.02
Domicile	Electronic data exchange	4.03	0.05	4	1	0.045
Education	E-prescription	7.29	0.00	20.95	3	0.0001
	Electronic data exchange	4.53	0.00	13.27	3	0.004
	RMP devices	2.87	0.04	8.51	3	0.04
	Thermometer	3.03	0.03	8.99	3	0.03
	Pressure gauge	3.58	0.01	10.56	3	0.01
	Heart rate monitor	2.84	0.04	8.44	3	0.04
	Electronic camera	2.92	0.03	8.67	3	0.03
	mHealth apps	2.84	0.03	8.43	3	0.04

ANOVA and χ2 test indicate a correlation between health assessment and life-saving wristband use. The ANOVA suggests that respondents with a very good health assessment (M = 0.46; SD = 0.51) tend to use the life-saving wristband more frequently than respondents with a good evaluation (M = 0.27; SD = 0.44). In contrast, the χ2 test indicates that those rating their health very well (38.46%) use the life-saving wristband more frequently than those rating poorly (7.94%).

Both ANOVA and $\chi 2$ test indicate a strong relationship between gender and mobile phone use for teleconsultation. ANOVA indicates that men choose teleconsultation more often (M = 0.69; SD = 0.47) than women (M = 0.53; SD = 0.5). This is confirmed by the $\chi 2$ test (68.64% vs. 53.25%).

Another characteristic of seniors is age. One-way analysis of variance ANOVA and $\chi 2$ test indicate a relationship between age and use of RMP devices, video consultation, electronic cameras, and life-saving wristbands. The ANOVA indicates that those aged 60-64 tend to use a mobile phone (M = 0.59; SD = 0.49) and an electronic camera (M = 0.28; SD = 0.45) more frequently for health monitoring than those aged 75 and over (respectively: M = 0.29; SD = 0.46; M = 0.09; SD = 0.29). This is confirmed by and $\chi 2$ test (respectively: 59.14% vs. 29.47%; 27.96% vs. 9.47%). Those aged 60-64 tend to use RMP devices (M = 0.70; SD = 0.46) and electronic cameras for health monitoring more frequently (M = 0.22; SD = 0.41 than those aged 70-74 (respectively: M = 0.43; SD = 0.50; M = 0.08; SD = 0.27). This is confirmed by the $\chi 2$ test (respectively: 69.89% vs 43.40%; 21.51% vs. 7.55%). Those aged 65-69 tend to use a life-saving wristband (M = 0.11; SD = 0.31) and a mHealth application (M = 0.16; SD = 0.37) more frequently to monitor their health than those aged 70-74 (respectively: M = 0.02; SD = 0.14; M = 0.05; SD = 0.21). The $\chi 2$ test confirms a significant relationship in the case of the life-saving wristband (16.04% vs. 4.72%). In contrast, for using a miHealth app, the $\chi 2$ test shows that people aged 60-64 (10.75%) tend to use it more often than those aged 70-74 (1.89%).

One-way ANOVA analysis of variance indicates a relationship between marital status and mobile phone use for teleconsultation, electronic data exchange, and RMP devices. Those who are divorced tend to use the mobile phone more frequently for teleconsultations (M = 0.65; SD = 0.48;) than those who are single (respectively: M = 0.38; SD = 0.49;). Married people use RMP devices more often (M = 0.58; SD = 0.05) than divorced people (M = 0.35; SD = 0.48). $\chi 2$ test shows a relationship between marital status, mobile phone use for teleconsultation, and use of RMP devices. Married people use the mobile phone more often for teleconsultation (66.67%) than single people (37.50%). Married people use RMP devices more often (58.73%) than divorced people (34.69%). The $\chi 2$ test does not indicate a correlation between marital status and mobile phone use for electronic data exchange.

Another characteristic examined was the respondents' place of residence. Both ANOVA and $\chi 2$ test indicate a strong relationship between place of residence and computer use for electronic data exchange. Urban residents (M = 0.53; SD = 0.5) use the computer for electronic data exchange more often than rural residents (M = 0.40; SD = 0.49). This is confirmed by the $\chi 2$ (53.41% vs. 39.68%).

The following statistically tested characteristic of seniors was education. One-way analysis of variance ANOVA and $\chi 2$ test indicate that there is a relationship between education level and mobile phone use for e-prescription, electronic data exchange, RMP devices, remote patient body temperature monitoring, remote blood pressure monitoring, remote heart rate monitoring, electronic cameras and mHealth apps for health monitoring. The ANOVA indicates that those

with higher education tend to use their mobile phone more frequently for e-prescribing (M = 0.69; SD = 0.46) and electronic data exchange (M = 0.63; SD = 0.48) than those with primary education (respectively: M = 0.4; SD = 0.49; M = 0.33; SD = 0.48,). This is confirmed by and $\chi2$ test (respectively: 69.47% vs. 63.16%; 39.58% vs. 33.33%). Those with higher education tend to use RMP devices (M = 0.6; SD = 0.49), the use of an electronic camera (M = 0.25; SD = 0.44) and mHealth applications (M = 0.19; SD = 0.39) for health monitoring than those with vocational education (respectively: M = 0.31; SD = 0.47; M = 0.42; SD = 0.5; M = 0.09; SD = 0.29; M = 0.06; SD = 0.23). This is confirmed by and $\chi2$ test (respectively: 51.58% vs 31.11%; 60.00% vs. 42.22%;25.26% vs. 8.89%; 18.95% vs. 5.56%). Those with a secondary education tend to use a remote thermometer (M = 0.38; SD = 0.49), remote blood pressure system (M = 0.38; SD = 0.49) and remote pulse oximeter (M = 0.38; SD = 0.39) more frequently to monitor their health than those with vocational education (respectively: M = 0.22; SD = 0.42; M = 0.22; SD = 0.42; M = 0.22; SD = 0.42). This is confirmed by and $\chi2$ test (respectively: 38.32% vs 22.22%, 38.92% vs. 21.11%, 37.72% vs. 22.22%).

4. Discussion

The COVID-19 pandemic rapidly increased access to e-health in many countries, including Poland. In this study, we were interested in using different e-health systems by older people from Poland. Based on surveys conducted during the COVID-19 pandemic, this study examined the use and opinions about e-health, and also the socio-demographic factors that influence the use of e-health from the perspective of older patients.

Due to the high potential risk of contracting the COVID-19 virus (Napitupulu et al., 2021), patients worldwide have become more willing to use online treatment (Kruse et al., 2017). Older patients in Poland also gained the opportunity to use e-health systems during the COVID-19 pandemic. However, the level of use of these systems by older people in Poland can be assessed as under average (mean = 2.77), which indicates that the use of e-health in Poland may not be effective. The largest group of respondents (35.25%) assessed using e-health at an average level. As many as 25% of older patients did not use RMP devices. However, it is worth noting that access to ICT devices is very high (smartphone - 100%) among the respondents. Similar research in Australia showed that although most older participants (around 88%) had access to ICT devices, few (only around 9%) had used e-health services (Ali et al., 2021). The results of another study conducted in Poland on the demand for telemedicine services for the ageing generation showed that it is low and concerns younger patients who accept information technologies as something useful in everyday life (Buliński, Błachnio, 2017). Among Polish seniors who declared their willingness to use specific telemedicine services, the oldest ones – those over eighty– were missing. Compared to the established

telemedicine market in the United States, Scandinavia, etc., the number of potential e-Health patients is, therefore, unsatisfactory, as documented in the results of other studies (Bujnowska-Fedak, Pirogowicz, 2014). The reason for the average use of e-health systems may be the digital divide among older people, which translates into limitations in the practical use of modern technologies in health monitoring and intergenerational communication (Sun Lim, Ling Tan, 2003). A limiting health problem is older people's auditory and visual content processing. The deteriorating hearing sensitivity constitutes a medical block to the use of, for example, teleconsultation (Sugawara et al., 2004). Technological illiteracy among the oldest age groups further exacerbates communication difficulties. Digital marginalisation condemns older people, particularly a lack of accessibility to advanced health monitoring methods and tools (Wong et al., 2014).

Most people in the study showed very negative attitudes towards e-health systems. Our study showed that 45% of older people believed that e-health systems were of little use in the medical care of patients. Such poor assessments can be explained by limited trust in e-services, in which the senior does not have a personal relationship with the service provider. They may also result from the limitations of seniors in using e-health due to the high costs, complexity in use and implementation of some telemedicine services (Buliński, Błachnio, 2017). A detailed analysis of the responses provided by Polish participants regarding e-health documents their selective interest in specific services. From the wide range of available services, Polish seniors found four useful: online registration of visits, receiving reminders about visits via text messages, biometric telemonitoring, and remote access to patient portals (Buliński, Błachnio, 2017). Patients receive prescriptions and referrals for laboratory and imaging tests on such portals, access educational information and order services. Previous research has shown that patient portals can improve medication adherence, provide better patient-provider communication, and enable the detection of medical errors (Dendere et al., 2019). This form of access gives patients more control and encourages them to be active users of the e-health systems (Nestlerode et al., 2022). Our results regarding the weak assessment of e-health usefulness by older patients contradict those conducted among healthcare workers. For example, studies conducted in China showed relatively positive evaluations and attitudes towards e-health, where only less than 5% of participants believed telemedicine did not help reduce the medical burden on patients (Ma et al., 2022).

Our results showed that health status, gender, age, marital status, place of residence, and education level are associated with using e-health services. The study showed that health status is an important factor influencing the use of telehealth systems because the patients with good and very good health declared a higher level of e-health use than those with poor or very poor health. In contrast, other studies have shown that people in good health are less likely to use e-health services based on ICT technologies (Andreassen et al., 2007; Huang et al., 2020; Wagner et al., 2004). The patients with health problems were more likely to use remote health monitoring, and this finding was supported by studies conducted in Ethiopia (Kassaw et al.,

2024), Australia (Bonner et al., 2018), China (Dai et al., 2017), Greece (Bonner et al., 2018), and Kenya (Miller, Himelhoch, 2013). However, this was based on survey data from the general population, not older people in particular. Further research is needed in this area.

Our study indicated a strong relationship between gender and mobile phone use for teleconsultation and that men choose teleconsultation more often. Results from other studies have shown that, in general, women were relatively less likely to use teleconsultations compared to men (Vera Cruz, Dlamini, 2021). One possible explanation for this difference may be that women are generally more likely to have complex health problems requiring special physical examination (e.g. gynaecological health problems), privacy, support and guidance compared to their male counterparts (Albrecht, Afshar, Illiger, Becker, Hartz, Breil, Wichelhaus, von Jan, 2017). For this reason, women may feel more need for face-to-face consultations than men.

The study showed that age is an important factor influencing the use of telehealth systems because the oldest respondents (>75) declared a lower level of e-health use compared to younger groups. As age increases, the individual use of e-health systems is lower. This is confirmed by the results of other studies, which showed that older people are less able than younger people to use electronic devices such as telerehabilitation platforms and mobile applications (Cimperman et al., 2016), and the oldest elderly are particularly digitally impaired (Zambianchi et al., 2019). Therefore, the patient's willingness to use remote health monitoring decreases with age. A possible reason for this may be that older patients are less willing to use new technologies than younger patients due to fear of use and concerns about information security and costs, as seen in studies conducted in Ethiopia (Kassaw et al., 2024), Germany (Albrecht et al., 2017; Illiger et al., 2014), Australia (Bonner et al., 2018), China (Dai et al., 2017), and Canada (Seto et al., 2010).

In many cases, older people are less likely to take advantage of digital technologies (König et al., 2018) and, therefore, risk being disadvantaged by the digital transformation in healthcare. For older adults, lack of technological competence is a significant challenge in adapting to e-health systems. Older adults often struggle with unfamiliar technology, preventing many from using telemedicine (Choi et al., 2023). However, it is unclear whether this finding is mainly influenced by life stage, associated with greater challenges in implementing new technologies due to chronic diseases or age-related personality changes. Digital impairment may also result from the fact that many e-health systems were introduced after the retirement of the oldest people (Zambianchi et al., 2019). Therefore, further research is needed to understand the causes of age-related digital impairment. Our findings regarding age are consistent with previous results on the determinants of eHealth use (Ali et al., 2020; Knapova et al., 2020; Vroman et al., 2015). Therefore, service providers should offer the oldest patients timely online or telephone support, especially in the form of concise user manuals, help and guidance for older users to understand e-health systems (Chan et al., 2023; Lee, Rho, 2013). To help older adults adopt new technologies, e-health systems should be designed with maximum user-friendliness

(Narasimha et al., 2017). For example, easy-to-use interfaces and simple instructions with larger on-screen fonts can help older adults use telemedicine to monitor chronic conditions during the COVID-19 pandemic.

Our study showed that marital status also influences the use of e-health systems. Married people use these systems much more often than people with other marital status. In our opinion, this may be due to the better mental health of people who still have their life partners. Previous research in the UK has shown that symptoms of poor mental health can impact readiness to use technology, and depression is likely to exacerbate difficulties in using digital technologies (Andrews et al., 2019). Further research would be necessary to more fully understand these relationships, such as examining how much depression or anxiety causes a lack of technology engagement among older adults.

Another characteristic that impacts e-health use by older adults is the respondents' place of residence. Urban residents use e-health systems more often than rural residents. For older adults living in rural areas, the digital infrastructure required to provide telemedicine services may be less robust than that in urban areas. However, given the long distances needed to reach hospitals and clinics, e-health systems can benefit residents of these regions (Guo et al., 2018).

Our results show people with higher education use e-health services more often than the elderly with primary and vocationally education. This finding is consistent with previous work on the impact of education on e-health use (Alam et al., 2019; Ali et al., 2020, 2021; Elliot et al., 2014; Menéndez Álvarez-Dardet et al., 2020; Salwin et al., 2022). Higher educational attainment may have provided older adults with general skills or specific ICT knowledge that facilitates the use of e-health (Elliot et al., 2014). However, people with lower levels of education may lack knowledge about e-health tools and, therefore, have no motivation to use such technologies (Alam et al., 2019; Elliot et al., 2014). The importance of education highlights the need to address the digital disadvantages older people face cross-cuttingly.

This study makes some key contributions to the literature. First, it focuses specifically on older adults rather than broader age groups. This is the first study on a group of older people conducted in Poland. The study's strengths include the ability to capture the current perspective of older Polish patients on telehealth systems after the pandemic outbreak. Unlike previous studies showing broad acceptance of telemedicine among the general patient population, our study focused on older adults and examined various e-health systems, not just telemedicine.

In practice, the research can have several implications for policy priorities in the field of ICT technologies regarding healthcare. First, our finding that older people have poor access to e-health tools such as RMP systems suggests that further programs to increase their accessibility are important. Second, our findings regarding education suggest that digital literacy is also important. Finally, our findings that the oldest people (over 75) are more disadvantaged than younger groups suggest that attention should be paid to this group, particularly in ensuring access to e-health and digital skills. The generational digital divide can be solved through interventions that promote the use and, above all, the personal experience of perceiving the

usefulness of e-health among older people who are less familiar with new technologies (Laganá et al., 2011).

5. Conclusions

Older adults should be considered the most important users of e-health, taking into account the fact that the way they use and perceive these systems is especially important for sustainable development. However, the use of e-health systems by older patients in Poland is on the whole inadequate. Most of these people have generally negative opinions and attitudes towards e-health services.

The study examined the determinants of e-health use among older adults in Poland. The level of use of e-health by respondents varied in terms of socio-demography and health. We found that gender, age, education, marital status, place of residence, and health status impact the use of various e-health systems by older people in Poland. Our study indicates that men and married people use teleconsultation more often. On the other hand, the systems for remote monitoring of patients' health are more popular among married people, with higher education, aged 60-64, with better health status. Urban residents use the computer for electronic data exchange more often than rural residents.

This finding should inspire policymakers, especially the Ministry of Health, to increase and expand the use of e-health systems by encouraging older patients with health problems, especially from rural areas, to use remote patient monitoring technologies and ICT devices to treat their diseases. The importance of e-health will grow as societies age and technology develops. In future research, it would be worthwhile to investigate problems in the practical application of telehealth that raise deep concerns among older people. The use of incentives could then be increased, increasing satisfaction with e-health systems.

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