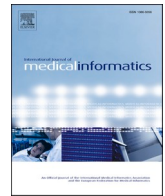




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User satisfaction and the readiness-to-use e-health applications in the future in Polish society in the early phase of the COVID-19 pandemic: A cross-sectional study

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ABSTRACT

Introduction: The COVID-19 pandemic resulted in the rapid expansion of e-health services in Poland. The main aim of the study was to assess the determinants of user satisfaction and the readiness-to-use e-health applications in Polish society.

Patients and methods: The paper presents the results of the analysis of the data obtained through a computer-assisted web interviewing survey in a representative sample of 1002 adult Internet users in Poland. The survey was based on a questionnaire consisting of 55 items. The determinants of user satisfaction and the readiness-to-use of e-health solutions were assessed with univariable and hierarchical logistic regression models.

Results: E-health services had been used by 60.6% of respondents from the beginning of the epidemic state in Poland to June 2020, when the survey was performed. The hierarchical model showed that user satisfaction with e-health interactions was significantly associated with HL (Health Literacy) and eHL (e-Health Literacy), COVID-19-related conspiracy beliefs score, and using a televisit because of acute symptoms not suggesting COVID-19. Readiness-to-use e-health in the future showed a significant relationship with place of residence, marital status, eHL, the self-assessment of knowledge about preventing COVID-19, the use of televisits for renewing prescriptions, and the level of satisfaction with e-health services.

Conclusions: Satisfaction with e-health services depends mainly on the HL, eHL, and conspiracy beliefs of patients. Readiness-to-use e-health in the future is associated with the level of eHL and sociodemographic characteristics, but previous experience with e-health services seems to be the main predictor.

1. Introduction

The COVID-19 pandemic has increased the interest in e-health and related technology solutions. The need to limit direct contact while providing citizens with access to health services is the typical situation for which e-health and telemedicine systems being considered necessary [1,2]. Providing such services make it possible to avoid direct contact while enabling it possible to monitor patients' condition and communicate the recommendations of doctors and other health care professionals. Experience to date shows that telemedicine systems have been effective in providing care to people with initial complaints suggesting infection with SARS-CoV-2, those who have had earlier contact with infected people and are in quarantine at home, or patients with confirmed COVID-19 and mild symptoms of the disease [3]. However,

the potential of such systems extends well beyond direct COVID-19 care. In the data analyzed in this paper, collected in the early phases of the pandemic, the use of new telemedicine services in Poland was not principally COVID-related, but rather was used to provide a full set of medical service to all kind of patients. The rapid uptake of these systems was aided by decreased distrust of remote medical contact after the beginning of the COVID 19 pandemic [4].

The importance of telemedicine and e-health systems in the context of the epidemic has also been emphasized by national and international medical societies and communities. Emergency medicine specialists expressed their position, pointing out that the use of telemedicine systems protects health care workers against infection, especially when providing care to patients with mild symptoms in the course of a SARS-CoV-19 infection [5]. They have also emphasized the usefulness of such

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solutions for protecting high-risk subjects, e.g., the elderly or people with comorbidities, by reducing their exposure to hospitals or other health care facilities, and also to patients with acute symptoms of infection. Finally, the use of e-health systems enables redistribution of access to health care workers between areas less and more affected by the COVID-19 epidemic [5]. The perception of the importance of digital technologies in the context of the pandemic threat prompted Robbins et al. to title their paper published in April 2020 – ‘COVID-19: The new digital dawn?’ [6]. They pointed out that the SARS-CoV-2 virus epidemic has led to significant progress in the use of digital technologies in healthcare, particularly in areas such as communication strategies, education initiatives, and patient support.

All the potential benefits of using e-health and telemedicine solutions during the pandemic have motivated subsequent authors to consider them an important element of the response system [7].

Some authors have suggested that taking advantage of e-health solutions will result in a radical change in the future model of care, especially in primary care [8]. Still, there are unresolved issues of ad hoc use of e-health solutions, as well as questions regarding liability for errors and malpractice that may occur in the course of providing e-health services.

The last two decades have been groundbreaking in the development of e-health services [9]. In many countries, legislative initiatives have been taken to allow the provision of medical services with the use of ICT tools [8,10]. Legal acts have usually been accompanied with detailed organizational and technical requirements assuring the appropriate quality of services [11]. As a result, services such as e-prescription or e-referrals have been available in many countries for long time. The pandemic has just made people aware that solutions that can decrease an epidemic threat are already available [12,13].

In Poland, prior to the pandemic, the only accepted e-health services were websites providing health-related content and electronic registration for doctor visits. Given the never ending reforms of the health care system, more broadly implementing e-health systems was not a priority. According to the report ‘Future Health Index Polska 2019,’ the use of digital solutions among health care providers was quite common totaling 77 % [14]. The report also revealed that 36 % of patients would be ready to use remotely visit a physician in the case of symptoms not requiring emergency contact with a health care provider [14]. However, appropriate legislation has not been introduced. Furthermore, the National Health Fund did not start reimbursing services delivered via technical means until 2016. This resulted in low interest among health care providers to support patients with telemedicine and e-health solutions. Only at the beginning of 2016, did new versions of the Act on medical services [15] and the Act on the professions of a doctor and a dentist [16] enter into force, which allowed for the implementation of tasks for medical professional groups with the use of teleinformatic systems.

With the introduction of the state of epidemic emergency, and then the state of the epidemic, as in other countries, in Poland, there were also opportunities to use Information and Communication Technologies (ICT) to provide health services more widely than before. In the beginning of March 2020, the Ministry of Health (MoH) issued the recommendation that primary care physicians should first provide a televisit via phone or videoteleconferencing system to each patient who wishes to attend the clinic. Shortly afterwards, the National Health Fund (NHF) announced that not only primary care physicians, but also specialists, could provide televisits [17].

It is expected that in the longer term, the widespread use of e-health services in the context of the COVID-19 pandemic will lead to the greater acceptance of e-health services. Furthermore, many authors believe that widespread use of the opportunities offered by the e-health environment will lead to a radical change in the model of care in the future [8,18].

1.1. Objectives

The main aim of this study was to assess the experience of Polish society with the use of e-health services in the first phase of the COVID-19 pandemic, three months after announcement of the epidemic state. In addition to analyzing specific types of e-health services, the determinants of the users’ satisfaction and readiness-to-use e-health solutions in the future were also assessed. The analysis addressed the role of sociodemographic variables, health (HL) and e-health literacy (eHL), attitudes and opinions toward the COVID-19 pandemic, and the specific objectives and tools used for e-health interactions.

2. Materials and methods

2.1. Survey

The analysis presented in this paper is based on the data obtained from a computer-assisted web-based interviewing (CAWI) survey performed among a representative sample of 1002 respondents from the Polish population. The structure of the study sample reflected the population of adult Internet users living in Poland in relation to their gender, age, education, place of residence, and Nomenclature of Territorial Units for Statistics (NUTS) 1 region. The survey was performed in June 2020 by the PBS Company (Sopot, Poland) [19]. The participants were recruited from an Internet panel maintained by the Company. Given an involved population of 28,600,000, in 2019 according to the Main Statistical Office in Poland, a fraction of 0.5 and a confidence level of 0.95, the sample of 1002 respondents has sampling error of 3.1 % [20].

The participants were informed about the aims of the study. Only those respondents who confirmed their consent to join the study were allowed to fill out the survey questionnaire. The study was performed after receiving approval from the Bioethical Committee of the Jagiellonian University (Decision No 1072.6120.99.2020 issued on April 23, 2020).

2.2. Questionnaire

The survey was performed with a questionnaire consisting of 55 items asking about HL and eHL, the perception of the threat of the pandemic, future anxiety, conspiracy beliefs regarding the pandemic, the use of telemedicine and e-health solutions during the COVID-19 pandemic, and finally, the main sociodemographic characteristics. The HL of respondents was assessed with 16-item European Health Literacy Survey Questionnaires (HLS-EU-Q16) [21] developed and validated within the European Health Literacy Survey Project [22]. eHL was measured on an 8-item e-Health Literacy Scale [23,24].

2.3. Statistical analysis

The statistical analysis was carried out with the IBM SPSS v.24 software (IBM Corp., Armonk, NY, USA). Absolute and relative frequencies have been calculated for the categorical variables, and the mean and standard deviation (SD) for numerical variables.

The determinants of user satisfaction and readiness-to-use e-health-based services in the future have been assessed with univariable and hierarchical logistic regression models. Independent variables significantly associated with the dependent variables have been included in the hierarchical regression models. For both dependent variables, hierarchical models consisting of four stages have been developed. For the developed models, the Hosmer-Lemeshow test and Nagelkerke R^2 were established. The effects of independent variables were presented as the odds ratio (OR), 95 % confidence intervals (95 %CI), and p-values and as adjusted OR (aOR), 95 %CI and p-value for hierarchical models. Statistical significance was assumed as $p < 0.05$.

2.4. Dependent variables

The variable reflecting user satisfaction with e-health services during the pandemic was established based on an item asking about ability to solve all issues indicated during a remote interaction with a physician. The readiness-to-use e-health in the future was analyzed based on the support for maintaining such services in the future. Responses to both items could be provided using a 5-point Likert scale, from ‘decidedly no’ to ‘decidedly yes’ with a neutral option in the middle. The variables derived from these two items have been dichotomized; the responses ‘decidedly yes’ have been assigned value ‘1’, and the remaining responses - value ‘0’.

2.5. Independent variables

Univariable logistic regression models have been developed with the following independent variables:

- sociodemographic variables: gender, age, place of residence, marital status, vocational status, monthly net income per household member,
- HL and eHL scores as continuous variables [24,25],
- COVID-19 related conspiracy belief score (C19CBS) based on three items asking about three popular conspiracy theories regarding the pandemic (detailed information about the items used for the assessment of the conspiracy beliefs was reported earlier [26])
- a variable reflecting the perception of the threat of the COVID-19 pandemic
- a variable reflecting the self-assessment of knowledge about preventive measures for the pandemic
- a variable reflecting the acceptance of social distance as a measure limiting the spread of coronavirus
- variables indicating the types of technical solutions used for remote contact with physicians
- variables related to the reasons for using e-health-based services (symptoms suggesting coronavirus infection, other acute symptoms, exacerbation of chronic disease, renewal of prescriptions, obtaining e-confirmation of sick leave)
- the use of e-health services for many purposes was included in the analysis as another variable.

3. Results

3.1. Characteristics of the study group

The mean age of the respondents was 40.1 (SD = 14.2); 42.0 (SD = 14.1) among those who used e-health during the pandemic and 37.4 (SD = 14.0) among non-users. The percentage of women in the study group was 50.6 %, 56.0 % among users and only 42.5 % among e-health non-users. The mean HL score in the study group was 12.9 (SD = 3.42); and the eHL score was 29.7 (SD = 5.1). The mean score (SD) of the COVID-19-related conspiracy beliefs (C19CBS) established based on the three items included in the questionnaire was, for the whole group, 10.25 (2.78), in the subgroup of e-health users, 10.13 (2.83), and among non-users, 10.42 (2.68). Detailed characteristics of the study group with a breakdown into e-health users and non-users are shown in Table 1. In this table, also the distribution of responses to items asking about opinions related to the COVID-19 pandemic was presented.

3.2. The use of e-health services during the pandemic

E-health services were used after the announcement of the epidemic state in Poland in the beginning of the March 2020 by 60.6 % (n = 607) of respondents. Among the users of e-health services, 46.3 % (n = 281) were the most certain about their ability to solve all problems during physician teleconsultations (Table 2). 39.6 % (n = 240) of e-health users

Table 1 Characteristics of the study group and opinions about the COVID-19 pandemic.

Variable	Categories of the variables	All respondents		E-Health users		E-Health non-users	
		%	n	%	n	%	n
Gender	Female	50.6	507	56.0	340	42.5	168
	Male	49.4	495	44.0	267	57.5	227
Place of residence	Rural	36.6	366	35.7	216	38.0	150
	Urban < 20,000	10.9	110	11.0	67	10.9	43
	Urban 20,000 to 200,000	30.2	302	29.4	178	31.4	124
	Urban > 200,000	22.3	223	24.0	146	19.7	78
Education	Lower than secondary	19.8	199	17.9	109	22.7	90
	Secondary or post-sec. non-university	48.9	490	48.2	292	50.0	198
	Bachelor's degree	10.7	107	10.4	63	11.2	44
	Master's degree	20.6	206	23.5	143	16.0	63
Monthly net income per household member	≤ 1,500 PLN	26.4	265	26.0	158	27.0	107
	1,500–3,000 PLN	42.6	427	45.7	278	37.8	150
	>3,000 PLN	18.0	180	19.3	117	15.9	63
Marital status	Refused to disclose	13.0	130	8.9	54	19.2	76
	Married	50.8	509	55.9	339	43.1	170
	Single	34.5	345	29.5	179	42.0	166
	Divorced, separated or widowed	14.7	147	14.6	89	14.9	59
Vocational status	Employee	47.2	473	47.8	290	46.2	183
	Self-employed or farmer	13.7	138	13.9	84	13.5	53
	On a disability pension or retired	9.6	96	11.5	70	6.7	26
	University or school student	10.2	102	7.9	48	13.7	54
COVID-19 pandemic is a serious threat to my and my family's health	Vocationally inactive incl. unemployed	19.3	194	18.9	115	19.9	79
	Decidedly no or no	25.7	258	22.4	136	31.0	123
	Difficult to say	27.6	276	26.1	159	29.7	117
	Decidedly yes or yes	46.7	468	51.5	312	39.3	155
My knowledge of prevention of spreading coronavirus is sufficient	Decidedly no or no	7.9	79	8.4	51	7.0	28
	Difficult to say	17.5	175	17.7	107	17.2	68
	Decidedly yes or yes	74.6	748	73.9	449	75.8	299
Social distancing is not justified in limiting the COVID-19 pandemic	Decidedly no or no	44.5	445	47.4	288	40.0	158
	Difficult to say	21.1	212	19.8	120	23.2	92
	Decidedly yes or yes	34.4	345	32.8	199	36.8	145

declared support for the future use of e-health and telemedicine services. Information about the aims and technical tools used for remote access to health care services is shown in Table 2.

3.3. Univariable logistic regression

Univariable logistic regression models revealed that satisfaction with e-health services (assessed by the ability to solve all problems during a teleconsultation) was significantly associated with HL and eHL scores, the C19CBS, the opinion about the importance of social distancing in prevention of the pandemic, the use of telephone for teleconsultations, and the use

Table 2
The aims and tools used for remote contact with a physician.

Variable	Response options	%	n
Have you managed to resolve all issues by using telemedicine/e-health services?	Decidedly no	2.4	15
	Rather no	5.4	33
	Difficult to say	6.8	41
	Rather yes	39.1	237
	Decidedly yes	46.3	281
Do you think that after the coronavirus epidemic, broad access to telemedicine/e-health services should be maintained?	Decidedly no	6.6	40
	Rather no	8.6	52
	Difficult to say	15.3	93
	Rather yes	29.9	182
	Decidedly yes	39.6	240
The aim of using telemedicine/e-health services	Symptoms suggesting coronavirus infection	No	96.2 584
		Yes	3.8 23
Other new symptoms	No	79.9	485
	Yes	20.1	122
Monitoring health status or exacerbation of chronic disease	No	79.1	480
	Yes	20.9	127
Renewal of prescription	No	39.2	238
	Yes	60.8	369
Obtaining the result of diagnostic procedures	No	87.5	531
	Yes	12.5	76
	No	88.2	535
Obtaining e-confirmation of sick leave	Yes	11.8	72
	No	89.4	542
	Yes	10.6	65
Disease of a child	No	64.8	393
	Yes	35.2	214
Use of telemedicine/e-health services for more than one aim	No	64.8	393
	Yes	35.2	214
Technical tool used to obtain physician's teledvice	Telephone-based physician consultation	No	35.4 215
		Yes	64.6 392
Videoteleconference with a physician or another health professional	No	95.6	580
	Yes	4.4	27
E-mail contact with a physician or another health professional	No	89.3	542
	Yes	10.7	65
Internet portal for patients	No	87.3	529
	Yes	12.7	78

of e-health services because of non-COVID-19 acute symptoms, the exacerbation of a chronic disease, or renewal of a prescription, and finally, the use of e-health services for more than one aim. Detailed results of the univariable logistic regression models for being decidedly satisfied with a televisit are presented in Table 3

In the case of the dependent variables reflecting readiness-to-use e-health services in the future, significant predictors included the place of residence, education level, marital status, eHL score, self-assessed knowledge about preventing spread of the coronavirus, the opinion about the role of social distancing, the use of telephone for televisits, the use of e-health services for renewing prescriptions, and the satisfaction with e-health services (Table 3).

3.4. Hierarchical logistic regression

In the first stage of the hierarchical logistic regression model of user satisfaction, HL and eHL scores have been included as independent variables (Hosmer-Lemeshow test, $p = 0.29$, Nagelkerke $R^2 = 0.067$); in the second stage, C19CBS has been added (Hosmer-Lemeshow test, $p = 0.48$, $R^2 = 0.082$); in the next stage the opinion about social distancing was added (Hosmer-Lemeshow test, $p = 0.66$, $R^2 = 0.095$); and finally, in the last stage the variable indicating the use of telephone and the variables reflecting aims of the televisits have been included (Hosmer-Lemeshow test, $p = 0.332$, $R^2 = 0.129$) (Table 4). The final model confirmed that respondents with higher HL and eHL (OR, 95 %CI: 1.09, 1.03–1.15, and 1.06, 1.02–1.10, respectively) and those with lower C19CBS (95 %CI: 0.81, 0.67–0.98) were more likely to be decidedly

satisfied with televisits.

In the first stage of the hierarchical regression model for readiness to use e-health in the future, sociodemographic variables have been included (Hosmer-Lemeshow test, $p = 0.77$, $R^2 = 0.087$); in the second stage, the eHL score has been added (Hosmer-Lemeshow test, $p = 0.49$, $R^2 = 0.115$); in the third, the self-assessment of knowledge about prevention and the opinion about social distancing have been added (Hosmer-Lemeshow test, $p = 0.10$, $R^2 = 0.145$); and finally, in the fourth stage, the variable indicating the use of telephone televisits, the use of televisits for the renewal of prescriptions and being decidedly satisfied with televisits have been included in the model (Hosmer-Lemeshow test, $p = 0.003$, $R^2 = 0.283$). Detailed results of consecutive stages of the hierarchical regression modeling is shown in Table 5.

4. Discussion

Our study showed that as much as 60.6 % of the adult population, three months after announcing the epidemic state and widely introducing e-health services, had used remote access to health care providers at least once. It should be emphasized that symptoms suggesting COVID-19 infection were the reason for 3.8 % of the accessed remote services, 20.1 % were for other new symptoms, and 20.9 % for monitoring the course of chronic diseases. Furthermore, renewal of prescription was the most frequent motivation to use remote services (60.8 % of all users). About 12 % of e-health users wanted to receive e-confirmation of sick leave. The relatively low number of remote encounters associated with a suspected case of COVID-19 can be explained by the fact that during the first three months of the pandemic in Poland, the number of new cases was rather low (only 23,570 new cases by May 30, 2020) [27]. According to our findings, among those seeking physician's teledvice, as many as 65 % used the telephone as a telemedicine tool. The functionality of such remote encounters was greatly enhanced by other e-health services introduced to the Polish health care system shortly after or just before the announcement of the pandemic, including e-prescription and e-confirmation of sick leave [28].

Univariable regression models showed that satisfaction with televisits did not depend on the sociodemographic characteristics of e-health users. Respondents with higher HL and eHL, and with lower levels of conspiracy beliefs about the pandemic more often expressed definite satisfaction with televisits than those with lower HL and eHL and those with higher levels of conspiracy beliefs. In the case of the support for the future use of e-health services, place of residence, education, and marital status were significant predictors. Contrary to user satisfaction, readiness-to-use was not significantly associated either with the HL score or C19CBS. However, those with higher (rather than lower) eHL were more likely to show support for future use of e-health. It was rather unexpected that the perceived threat of the COVID-19 pandemic was not a significant predictor for any dependent variable. Conducting televisits by telephone as well as using televisits to renew prescriptions were significantly associated with a likelihood of higher satisfaction and readiness to use. Those demonstrating higher user satisfaction were also >4 times more likely to show decided support for the future use of e-health services.

According to the Integrative Model of eHealth Use macro-level disparities in social structures are associated with health disparities through mediating constructs on the micro-level, including e-health literacy, motivation and ability [29]. However, it should be underlined that this model focused strongly on e-health as a domain related to the use of the Internet in a health-related context, mainly for information searches. Indeed, there are many studies confirming the association between eHL and the use of online health-related information both in the general population [30–32] and among patients with specific diseases [33].

According to the review by Schreiweis et al., limited exposure and knowledge of e-health, including poor eHL, were most frequently mentioned in the literature as barriers to the use of e-health [34]. So far,

Table 3
Univariable logistic regression models of user satisfaction with and the readiness to use e-health applications.

Variable	Categories	User satisfaction		Readiness to use	
		OR (95 % CI)	p	OR (95 % CI)	p
Age		1.01 (1–1.02)	0.11	0.998 (0.99–1.01)	0.72
Health literacy		1.13 (1.07–1.18)	<0.001	1.03 (0.98–1.08)	0.18
E-Health literacy		1.07 (1.03–1.11)	<0.001	1.06 (1.03–1.10)	<0.001
C19CBS		0.78 (0.66–0.93)	0.005	0.93 (0.78–1.10)	0.39
Gender	Female				
	Male	0.73 (0.53–1)	0.05	1.04 (0.75–1.44)	0.81
Place of residence	Rural				
	Urban < 20,000	0.78 (0.45–1.37)	0.39	2.17 (1.23–3.82)	0.007
	Urban 20,000 to 200,000	1.19 (0.80–1.76)	0.40	2.09 (1.37–3.18)	0.001
	Urban > 200,000	1.05 (0.69–1.60)	0.83	2.44 (1.57–3.80)	<0.001
Education	Lower than secondary				
	Secondary or post-sec. non-university	0.99 (0.63–1.54)	0.96	1.16 (0.73–1.84)	0.54
	Bachelor’s degree	1.12 (0.60–2.09)	0.73	1.81 (0.96–3.41)	0.07
	Master’s degree	1.52 (0.92–2.51)	0.10	1.78 (1.06–2.99)	0.03
Monthly net income per household member	≤ 1,500 PLN				
	1,500–3,000 PLN	1.25 (0.84–1.85)	0.27	0.99 (0.67–1.49)	0.98
	>3,000 PLN	1.03 (0.64–1.67)	0.89	1.30 (0.80–2.11)	0.29
	Refused to disclose	0.85 (0.45–1.59)	0.61	0.89 (0.47–1.69)	0.72
Marital status	Married				
	Single	1.04 (0.72–1.49)	0.84	1.89 (1.31–2.74)	0.001
	Divorced, separated or widowed	1.29 (0.81–2.07)	0.28	1.68 (1.05–2.71)	0.03
Vocational status	Employee				
	Self-employed or farmer	0.83 (0.51–1.35)	0.44	0.93 (0.56–1.52)	0.76
	On a disability pension or retired	1.09 (0.65–1.84)	0.74	0.91 (0.53–1.55)	0.72
	University or school student	0.66 (0.35–1.23)	0.19	0.69 (0.36–1.33)	0.27
	Vocationally inactive incl. unemployed	0.78 (0.50–1.21)	0.27	1.15 (0.74–1.78)	0.53
The COVID-19 pandemic is a serious threat to my and my family’s health	Decidedly no or no				
	Difficult to say	1.04 (0.66–1.65)	0.87	1.10 (0.68–1.76)	0.71
	Decidedly yes or no	1.16 (0.77–1.73)	0.48	1.34 (0.88–2.04)	0.17
My knowledge of the preventing the spread of the coronavirus is sufficient	Decidedly no or no				
	Difficult to say	0.75 (0.38–1.48)	0.41	0.35 (0.17–0.70)	0.003
	Decidedly yes or no	1.22 (0.68–2.19)	0.50	0.72 (0.40–1.28)	0.27
Social distance is not justified in limiting the COVID-19 pandemic	Decidedly no or no				
	Difficult to say	0.53 (0.34–0.83)	0.005	0.62 (0.40–0.98)	0.04
	Decidedly yes or no	1.04 (0.72–1.49)	0.85	0.88 (0.61–1.28)	0.51
Telephone-based physician consultation	No				
	Yes	1.76 (1.25–2.47)	0.001	1.43 (1.01–2.02)	0.04
Videoteleconference with a physician or another health professional	No				
	Yes	0.83 (0.38–1.81)	0.63	0.89 (0.40–1.98)	0.78
E-mail contact with a physician or another health professional	No				
	Yes	1.31 (0.78–2.20)	0.31	1.61 (0.96–2.71)	0.07
Internet portal for patients	No				
	Yes	1.10 (0.68–1.78)	0.69	1.46 (0.90–2.35)	0.12
The aim of the physician’s televisit					
Symptoms suggesting coronavirus infection	No				
	Yes	0.97 (0.42–2.23)	0.94	1.57 (0.68–3.60)	0.29
Other new symptoms	No				
	Yes	1.68 (1.12–2.5)	0.012	1.05 (0.70–1.57)	0.82
Monitoring health status or exacerbation of chronic disease	No				
	Yes	1.49 (1.01–2.21)	0.05	1.42 (0.96–2.11)	0.08
Renewal of prescription	No				
	Yes	1.42 (1.02–1.97)	0.04	1.47 (1.05–2.07)	0.03
Obtaining the result of diagnostic procedures	No				
	Yes	1.13 (0.70–1.83)	0.62	0.97 (0.59–1.59)	0.91
Obtaining e-confirmation of sick leave	No				
	Yes	1.24 (0.76–2.03)	0.39	0.67 (0.40–1.14)	0.14
Disease of a child	No				
	Yes	0.998 (0.59–1.68)	0.99	1.23 (0.73–2.06)	0.45
Use of telemedicine services for more than one aim	No				
	Yes	1.58 (1.13–2.21)	0.007	1.33 (0.95–1.87)	0.10
Have you managed to resolve all issues by using telemedicine services	Response from decidedly no to rather yes				
	Decidedly yes			4.69 (3.30–6.66)	<0.001

Abbreviations: C19CBS, the COVID-19-related conspiracy belief score.

the association of HL and eHL with the usage of e-health understood more broadly, as an environment for accessing various types of health services, e.g., televisits to physicians or for renewals of prescriptions, has not been analyzed frequently. Instead, researchers have focused more on constructs derived from the relevant models of technology acceptance,

emphasizing such facilitators as the involvement of end-users in the design and delivery of e-health solutions, and such barriers as the lack of self-efficacy [35]. Although the lack of knowledge may be treated as a proxy of limited eHL, specific literacy measures have rarely been applied in such studies. It seems that interest in the impact of general literacy,

Table 4
Hierarchic logistic regression modelling of e-health user satisfaction.

Independent variables	Model 1		Model 2		Model 3		Model 4		
	OR (95 % CI)	p	OR (95 % CI)	p	OR (95 % CI)	p	OR (95 % CI)	p	
Health literacy	1.10 (1.04–1.16)	<0.001	1.10 (1.04–1.16)	0.001	1.10 (1.04–1.16)	0.001	1.09 (1.03–1.15)	0.003	
E-health literacy	1.05 (1.01–1.09)	0.008	1.06 (1.02–1.10)	0.004	1.06 (1.02–1.10)	0.004	1.06 (1.02–1.10)	0.003	
C19CBS			0.78 (0.65–0.94)	0.009	0.80 (0.67–0.97)	0.02	0.81 (0.67–0.98)	0.03	
Social distance is not justified in limiting the COVID-19 pandemic	Decidedly no or no Difficult to say					0.57 (0.36–0.91)	0.02	0.64 (0.40–1.04)	0.07
						0.94 (0.63–1.39)	0.74	1.02 (0.68–1.53)	0.94
Telephone-based televisit to a physician	No Yes						1.48 (1–2.20)	0.05	
Other new symptoms	No Yes						1.70 (1.04–2.77)	0.04	
Monitoring health status or exacerbation of chronic disease	No Yes						1.27 (0.77–2.09)	0.35	
Renewal of prescription	No Yes						1.48 (0.99–2.20)	0.06	
Use of telemedicine services for more than one aim	No Yes						0.95 (0.58–1.54)	0.82	
Hosmer-Lemeshow	0.287		0.480		0.664		0.332		
Nagelkerke's R ²	0.067		0.082		0.095		0.129		

Abbreviations: C19CBS, the COVID-19-related conspiracy belief score.

HL and eHL on the usage of e-health applications particularly increased during the COVID-19 pandemic [36–39]. Some authors have also reported that more frequent usage of e-health tools has been associated with higher HL [40].

Many earlier studies have been focused on the determinants of the frequency of e-health usage among various populations. The lack of a significant relationship between user satisfaction and the sociodemographic variables of e-health users is unexpected, taking into consideration earlier studies. Among the sociodemographic factors, younger age, being female, higher income, a higher level of education, or living in an urban area have been reported to be associated with more frequent usage of e-health [22,41–54]. However, the univariate regression model developed in our study revealed that sociodemographic variables were predictors of the readiness to use e-health applications in future. Residents of urban areas were more likely than those of rural areas, respondents with a University education were more likely than those with lower education, and singles or divorced people were more likely than married people to express higher readiness to use. It is rather difficult to speculate why readiness to use but not user satisfaction is significantly associated with sociodemographic factors. However, it seems that readiness to use is related to more general attitudes to the use of new technologies and it is to a higher degree influenced by the level of education or place of residence. In the case of user satisfaction, health and e-health-related capacities and features characterizing the course of remote encounters probably play more significant roles.

In our study, we have found that both HL and eHL were determinants of user satisfaction with televisits. This may suggest that systematic actions increasing HL and eHL in society could result in higher acceptance and the ability to benefit from e-health-based interactions. A broad review performed by Airola seems to support this notion [46]. The analysis of 31 studies revealed that help in learning about and using e-health was the most frequently indicated enabler of the use of e-health by older adults [46].

The satisfaction of users with videoconsultations provided by an

academic hospital during the COVID-19 pandemic was assessed by Barsom et al. [47]. Patients rated their experience with videoconsultations quite highly (8.3 in 10-point scale) and believed that it was a good solution for the provision of care during the pandemic. In our study, as many as 85.4 % of respondents agreed that they were satisfied with remote physician services, but the majority of them had used telephone-based and not video-based consultations.

In their review encompassing 2010–2020, Khalil et al. identified 39 factors affecting the continued intention to use mobile health applications [48]. Among them, user satisfaction was one of the most frequently reported determinants. Our study also showed that user satisfaction with e-health based interactions remains the main determinant of the readiness-to-use e-health in the future. This finding was confirmed by other authors analyzing the opinions of patients using telemedicine during the COVID-19 pandemic [49].

4.1. Limitations

Although the sample used in the survey was representative of the population of adult Internet users, a more numerous sample would probably shed more light on specific circumstances which occurred with low frequency in our study, e.g. the use of e-health services due to symptoms suggesting COVID-19.

We have dichotomized the dependent variables used in the regression models. This decision was dictated by our interest in simplifying the applied models and making interpretation of results easier. However, we are aware of the limitations of such an approach, including the possibility that some information is lost, and we can experience the loss of statistical power to detect the relationship between dependent and independent variables. On the other hand, in the case of categorical ordered variables with five response options according to the Likert, scale the loss of information should be not as significant as in the case of the dichotomization of continuous variables.

We have observed relatively high satisfaction with e-health services

Table 5
Hierarchic logistic regression modelling of e-health readiness to use.

Independent variables		Model 1		Model 2		Model 3		Model 4	
		OR (95 % CI)	p	OR (95 % CI)	p	OR (95 % CI)	p	OR (95 % CI)	p
Place of residence	Rural								
	Urban < 20,000	1.94 (1.08–3.46)	0.03	1.97 (1.10–3.54)	0.02	1.92 (1.06–3.49)	0.03	2.53 (1.33–4.82)	0.005
	Urban 20,000 to 200,000	1.90 (1.23–2.92)	0.004	1.91 (1.23–2.95)	0.004	1.89 (1.22–2.94)	0.005	2.03 (1.27–3.26)	0.003
	Urban > 200,000	2.21 (1.41–3.47)	0.001	2.25 (1.43–3.56)	<0.001	2.20 (1.38–3.48)	0.001	2.48 (1.51–4.06)	<0.001
Education	Lower than secondary								
	Secondary or post-sec. non-university	1.15 (0.71–1.85)	0.58	1.17 (0.72–1.90)	0.54	1.11 (0.67–1.84)	0.67	1.10 (0.65–1.87)	0.72
	Bachelor's degree	1.92 (0.996–3.71)	0.05	1.98 (1.02–3.85)	0.04	1.82 (0.92–3.60)	0.08	1.80 (0.87–3.72)	0.11
	Master's degree	2.05 (1.19–3.53)	0.01	2.07 (1.19–3.59)	0.01	1.94 (1.10–3.42)	0.02	1.71 (0.94–3.10)	0.08
Marital status	Married								
	Single	1.90 (1.29–2.80)	0.001	1.96 (1.32–2.90)	0.001	2.03 (1.36–3.03)	0.001	2.18 (1.42–3.36)	<0.001
	Divorced, separated or widowed	1.79 (1.09–2.95)	0.02	1.82 (1.10–3.02)	0.02	1.84 (1.10–3.08)	0.02	1.66 (0.96–2.88)	0.07
E-Health literacy			1.07 (1.03–1.11)	<0.001	1.07 (1.03–1.11)	<0.001	1.05 (1.01–1.09)	0.008	
My knowledge of the preventing the spread of the coronavirus is sufficient	Decidedly no or no					0.30 (0.14–0.63)	0.002	0.26 (0.12–0.59)	0.001
	Difficult to say					0.52 (0.27–0.998)	0.05	0.43 (0.21–0.88)	0.02
Social distance is not justified in limiting the COVID-19 pandemic	Decidedly no or no					0.64 (0.40–1.04)	0.07	0.80 (0.47–1.33)	0.39
	Difficult to say					0.78 (0.52–1.16)	0.22	0.84 (0.55–1.29)	0.42
Telephone-based physician consultation	No							1.25 (0.84–1.87)	0.27
	Yes								
Renewal of prescription	No							1.54 (1.04–2.27)	0.03
	Yes								
Have you managed to resolve all issues by using telemedicine services	Response from							4.44 (3.03–6.49)	<0.001
	Decidedly no to rather yes								
Decidedly yes									
Hosmer-Lemeshow	0.744		0.489		0.103		0.003		
Nagelkerke's R ²	0.087		0.115		0.145		0.283		

and a relatively high degree of readiness-to-use them in the future. As a result, to develop more balanced regression models, we have decided to dichotomize the dependent variables situating decided opinions about satisfaction and support for future use against less decided, undecided or opposing opinions.

We should also emphasize that this study reports the opinions of Polish e-health users in during a very early stage of the pandemic. An observational study such as this does not allow for deeper understanding of ongoing trends. We can expect that, with time, after some adaptation to the state of epidemic threat, the perception of the usefulness of e-health services may change and the expectations of the quality of care can rise. Such trends seem to be confirmed by some studies performed by specialized poll opinion companies in later phase of the pandemic [50,51].

5. Conclusions

A byproduct of the COVID-19 pandemic was enabling wide access to e-health services to all citizens living in Poland. As a result, we have experienced a phenomenon that could be described as a wide-scale natural experiment of the introduction of remote access to health services to a society which earlier had had very limited access to e-health-based contact with health care providers. This study was carried out in

the early phase of the pandemic in Poland, characterized by the low prevalence of SARS-CoV-2 infections but a high level e-health usage. Our findings indicate that the satisfaction of e-health users does not depend on sociodemographic characteristics, but rather on HL and eHL. Also, the aims of physician televisits and the tools used were important predictors of satisfaction. Interestingly, conspiracy beliefs about SARS-COV-2 should be taken into consideration when the promotion of new tools in health care provision is considered. As for readiness-to-use e-health in the future, the satisfaction with previously obtained services seems to be the main determinant. The level of eHL, but not HL, is another important factor. This study confirms earlier projections about the importance of health and digital health literacy in preparing society for broader use of innovative solutions, ensuring access to health services, especially in the state of epidemic emergency.

Authors' contributions

MD conceived the concept of the study and designed the research. MD and NT analyzed the data. MD coordinated funding of the project. All authors edited and approved the final version of the manuscript.

Summary table

(continued on next page)

(continued)

What was already known on the topic?	<ul style="list-style-type: none"> Polish society had limited access to tele-advice from health professionals in pre-pandemic period. The importance of health and e-health literacy was not assessed among users of e-health services before.
What this study added to our knowledge?	<ul style="list-style-type: none"> User satisfaction with remote health services during the pandemic depends on health and e-health literacy. User satisfaction is also related to conspiracy beliefs about COVID-19 User satisfaction is the main predictor of readiness-to-use of e-health services in the future.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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