 doi:10.20944/preprints202210.0026.v1

Article

Digital Skills, Perceptions of Dr. Google, and Attitudes of e-Health Solutions among Polish Physicians: A Cross-Sectional Survey Study

Joanna Burzyńska*, Anna Bartosiewicz and Paweł Januszewicz

Institute of Health Sciences, Medical College of Rzeszow University, 35-959 Rzeszów, Poland; abartosiewicz@ur.edu.pl (A.B.), pjanuszewicz@ur.edu.pl (P.J.)
* Correspondence: jburzynska@ur.edu.pl; Tel.: +48-17-851-68-11

Abstract: The investment in digital e-Health services is a priority direction in the development of global health care systems. While people are increasingly using the Web for health information, it is not entirely clear what is the physicians' attitude towards digital transformation, and the acceptance of new technologies in healthcare. The aim of this cross-sectional survey study was to investigate physicians' self-digital skills, and their opinions on obtaining online health knowledge by patients, as well as the recognition of physicians' attitudes towards e-Health solutions. Principal Component Analysis (PCA) was performed to emerge the variables from self-designed questionnaire, and cross-sectional analysis comparing descriptive statistics and correlations for dependent variables using the one-way ANOVA (F-test). 307 physicians participated in the study, reported using the internet mainly several times a day (66.8%). Most participants (70.4%) were familiar with new technologies and rate their e-Health literacy high, although 84.0% reported the need for additional training in this field, and reported a need to introduce a larger number of subjects shaping digital skills (75.9%) in medical studies 53.4% of physicians perceived Internet-sourced information as sometimes reliable, and in general assessed the effects of using it by their patients negatively (41.7%). Digital skills increased significantly with frequency of internet use ($F = 13.167$; $p = 0.0001$), and decreased with physicians' age, and the need for training. Those who claimed that patients often experienced health benefits from online health showed higher digital skills (-1.06). Physicians most often recommended their patients to obtain laboratory test results online (32.2%), and to arrange medical appointments via the Internet (27.0%). Along with the deterioration of physicians' digital skills, the recommendation of e-Health solutions decreased ($r = 0.413$), and lower the assessment of e-Health solutions for the patient ($r = 0.449$). Physicians perceive digitization as a sign of the times, and frequently use its tools in daily practice. The evaluation of Dr. Google's phenomenon and online health is directly related to their own e-Health literacy skills, but there is still a need for practical training to deal with digital revolution.

Keywords: online health information; digital literacy; e-Health; e-Health solutions; Dr. Google

1. Introduction

By the beginning of 2022, the number of internet users has reached a global 4.95 billion which means 65% of world population is online [1]. The Internet has undoubtedly become one of the most popular source of medical information in the field of definition, symptoms and diagnosis of the disease, healthy lifestyles, medications, alternative medicine, medical devices and the functioning of the entire medical care system [2-5]. Studies confirm that searching for health-related content is not the only reason to use Internet – consumers more and more frequently before seeing a doctor - ask Dr. Google for online consultation [3,6-9]. This situation begins to occupy an equal place in the doctor-patient interaction. Previous studies suggested that relation between consumers and healthcare professionals may be a motivation to search for health information online [10-

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 5 October 2022 doi:10.20944/preprints202210.0026.v1

12]. On the other way numerous studies have explored the situation of clinicians who are aware that their patients seek the popular Web domains for health information, by paying attention to the positives and negatives of such conduct [13-15]. This phenomenon known as "Dr. Google" identifies the complex effects and consequences of searching for online health information – a kind of medical autonomy for patients, and the role of professionals with their appropriate knowledge and practice [15]. Researchers pointed out that people who seek health materials in the Web differ in age, income, and education levels from those seeking information offline [8]. There are data indicating that younger people, who are in worse health condition, seek access to this information more often [13]. They are also ones with a higher socio-economic status and better educated, most often women [16]. Interestingly, half of all searches are made on behalf of another person [16].

Despite its popularity, literature suggests that patients still value the health professionals' advice [15,17], which might be a suggestion that physicians can play an important role in online health navigation, and the need to have a proficiency in digital skills is even more vital. The implementation of Information Communication Technology (ICT) may be the answer to this challenge and can provoke to remain open to technological opportunities and possession of skills to manage them [18]. For physicians, ICT competences might be relevant for several reasons; starting with the fact that medical technology is advancing and daily tasks handling health data is challenging (e.g. Electronic Health Record, Electronic Documentation, and Health Information System), and ending with patient-consumer personalized, and individualized demands [19]. However, todays profession practice is not only dependent on this duo. In the new European Skills Agenda, the European Commission sets objectives for upskilling (improving existing skills) and reskilling (training in new skills) the workforce in the next five years [20]. In its policy paper on digital skills for doctors the Standing Committee of European Doctors highlights three main areas of digital skills: general, technical and related to patient-doctor relationship [21]. These new competences should be included in the future medical programs of study, adapted to a doctor's medical speciality, and keep current and future physicians up-to-date with tech innovations.

Few years ago, the European Commission has defined resources to efficiently use the possibilities of new technology as digital literacy [22]. According to Bawden, digitally literate person have the knowledge and ability to effectively and critically navigate, evaluate and create information using a range of digital technologies, as well as using the Internet and technology tools to achieve academic, professional and personal goals [23]. The medical education of Polish physicians is evidence-based but in context of the challenges related to Dr. Google, technological development and the ubiquity of the Internet, it might not be sufficient.

Overall, current study aimed to answer main research problem: to understand the digital aspects of healthcare from the perspective of Polish physicians. To know better the herefore, we propose the following research questions:

Q.1 How do physicians evaluate their digital skills and digital literacy, and what variables determine this?

Q.2. How do physicians perceive the quality and usefulness of online health information for their patients, and what variables determine this?

Q.3. How do physicians evaluate e-Health solutions in general, and what variables determine this?

Q.4. Do physicians recommend e-Health solutions to their patients, and what variables determine this?

To our knowledge, no research exists examining digital literacy, perception of online health information, and attitudes towards e-Health solutions from physicians' perspective in Poland. As a part of a larger study of healthcare professionals and patients, the aim of this research was to better understand the phenomenon in the aspect of digitalization of Polish healthcare sector. Physicians' opinions of self-digital skills, health internet-source information, and e-Health solutions seem particularly interesting also in the context of the digitization of medical services.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 5 October 2022 doi:10.20944/preprints202210.0026.v1

2. Materials and Methods

2.1. Study design

This is a cross-sectional, descriptive study conducted among 307 professionally active physicians between December 2019 to April 2020, in the South-Eastern Poland. The current study is a part of a larger ongoing project conducted to explore attitudes towards e-Health, digital literacy, and online health information among healthcare sector representatives (physicians, nurses [23]) and patients. The self-designed questionnaire, used in this research, were distributed among the following healthcare facilities employing physicians: primary healthcare (PHC), outpatient specialist care (AOS), hospitals (at different levels of locality), and private sector. Respondents participated in this study ensured sample diversity working in South Eastern Poland (the error threshold was 5%, i.e., the test power was 0.95). Before participating in the survey, respondents were provided with detailed information about the purpose of the study, assured of its anonymity, and that they have the option to opt out at any stage of it.

2.2. Questionnaires

This survey adopted a structured self-designed questionnaire to obtain data from physicians, and included a sociodemographic section with questions about age, gender, specialization, workplace, and number of patients seen per month. Surveyed physicians were also asked to indicate the frequency of using the Internet and electronic devices.

The questionnaire had also four sections that included:

- "Digital Literacy" section on self-assessment of the ability to use digital devices and solutions, and evaluation the frequency of using digital devices and solutions in private and professional life (smartphone, computer, e-mail, mobile applications, and tablet);
- "The impact of the Internet / new technologies on healthcare and modern life" section concerning the general assessment and opinion on the use of the search engine / Internet in the context of health;
- "Recommendation of e-Health solutions" section containing statements regarding the present / future recommending or not recommending e-Health solutions to the patients,
- "Evaluation of e-Health solutions" section with self-assessment of the relevance of the proposed e-Health solutions;

Questionnairie template is included in Supplementary Materials as File S1: Questionnaire.

2.3. Ethics

The study was approved by the institutional Bioethics Committee of the Rzeszow University (Resolution No. 6/12/2019) and all relevant administrative bodies.

2.4. Data analysis

In this study principal component analysis (PCA), using the Anderson-Rubin method, was carried out to determine constructs in questionnaire regarding: "Digital literacy", "The impact of the Internet / new technologies on healthcare and modern life", "Recommendation of e-Health solutions", and "Evaluation of e-Health solutions". The reliability of each construct was also determined by the Cronbach's alpha coefficient. A significance level of $p < 0.05$ was assumed.

Descriptive statistics were conducted to present the data: frequency (n), percentage (%), arithmetic mean (M), the value of which determines the average level of a given variable, and standard deviation (SD), a statistical measure of scattering the results around the expected value.

Then, correlation analysis were performed. The t-tests and chi-square tests for two-group comparisons in sociodemographic variables (gender and workplace) were performed. Nonparametric Spearman Rho correlation coefficient test was used to compare the non-normally distributed numerical data in correlation analysis with age.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 5 October 2022 doi:10.20944/preprints202210.0026.v1

Differences in mean values in the cross-sectional analysis were calculated using the one-way analysis of variance for the cross-sectional groups ANOVA (F test). To measure the linear relationship between all digital indicators the Pearson correlation (r) was used.

Statistical significance was evaluated at $p < 0.05$.

Calculations were performed with the IBM SPSS program Statistics 20 (IMB, Armonk, NY, USA).

3. Results

3.1. The Reliability and Validity of Questionnaires

The Cronbach's alpha and PCA were calculated for each construct in questionnaire:

- Digital literacy: the Cronbach's alpha: 0.571, PCA: two components ("Own skills", and "Need for training") explaining 61.6% of the variance;
- The impact of the Internet / new technologies on healthcare and modern life: the Cronbach's alpha: 0.462, PCA: one variable explaining 65.0% of the variance;
- Recommendation of e-Health solutions: the Cronbach's alpha: 0.865, PCA: one component explaining 52.1% of the variance;
- Evaluation of e-Health solutions: the Cronbach's alpha: 0.928, PCA: two components ("Patients" and "Medical facility") explaining 69.0% of the variance.

3.2. Characteristics of the Study Group

307 physicians participated in the study, including 168 (54.7%) females and 139 (45.3%) males. The mean age of the respondents was 44.39±14.21 years, ranging from 26 to 78 years. Every fourth physician was not more than 31 years old, and every fourth was not younger than 54 years old. The dominant specialization (N=136; 44.3%) among practitioners was family medicine. 32 (10.4%) paediatricians, 28 (9.1%) orthopaedists, 27 (8.8%) internists, 18 (5.9%) neurologists, and 11 (3.6%) gynaecologists also participated in the study. Data was also collected from 7 (2.3%) cardiologists and anaesthesiologists, 6 (2.0%) pulmonologists, 5 (1.6%) dermatologists, 3 (1.0%) dentist, 6 (2.0%) residents and 9 (2.9%) doctors during specialization. The vast majority of participants were employees of primary healthcare (81.4%), less often employees of hospitals (34.9%) or other places. 253 (82.4%) of physicians also conduct private practice. Nearly half of professionals (N=148; 48.2%) saw more than 200 patients within a month. Between 50 and 100 patients were seen monthly by 28% (N=86) of physicians, and 12.4% (N=38) declared monthly care for less than 50 patients. 11,4% (N=35) professionals saw monthly between 100 and 200 patients (File S2_Table 1-5). The surveyed clinicians reported they use the Internet mainly several times a day (66.8%) or every day (19.9%) (Fig.1).

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 5 October 2022 doi:10.20944/preprints202210.0026.v1

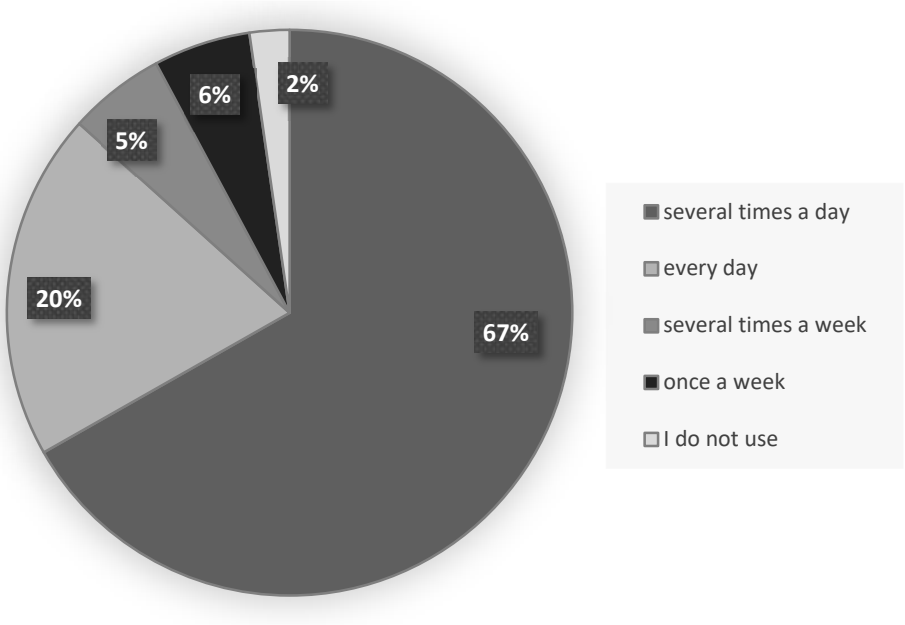

Figure 1. Distribution of the frequency of internet use by surveyed physicians.

In private life, physicians mainly used a smartphone (83.4%), e-mail (70.7%) and a computer (65.8%). In their professional work, clinicians mainly use a computer (85.0% often) and smartphone (47.6% often) (Table 1).

Table 1. The frequency of the electronic devices usage by physicians in private and professional life.

Type of Electronic Device	Often		Sometimes		Never		N/A	
	N	%	N	%	N	%	N	%
Private usage								
Smartphone	256	83.4	23	7.5	24	7.8	4	1.3
Computer	202	65.8	94	30.6	8	2.6	3	1.0
E-mail	217	70.7	59	19.2	20	6.5	11	3.6
Mobile apps	173	56.4	80	26.1	44	14.3	10	3.3
Tablet	70	22.8	104	33.9	107	34.9	26	8.5
At work								
Smartphone	146	47.6	75	24.4	65	21.2	21	6.8
Computer	261	85.0	31	10.1	14	4.6	1	0.3
E-mail	95	30.9	116	37.8	82	26.7	14	4.6
Mobile apps	76	24.8	103	33.6	103	33.6	25	8.1
Tablet	16	5.2	21	6.8	224	73.0	46	15.0

3.3. Physicians' Digital literacy and e-Health Indicators

Clinicians described their skills in using digital devices or e-Health solutions as very good (33.6%) or good (32.6%) (File S2_Table 7). However, most of the respondents admitted they will take advantage of additional training or courses in the field of shaping digital competences (84.0%), and there is a need to introduce a larger number of subjects shaping digital skills (75.9%) in medical studies, but they felt prepared to support e-Health solutions (70.4%). Clinicians disagreed with the statement (43.0%) that today's medical education keeps pace with the digital challenges of the 21st century. Participants shared

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 5 October 2022 doi:10.20944/preprints202210.0026.v1

more (40.1%) or less (37.8%) the opinion that the Internet would revolutionize healthcare, and in 57.3% they considered new technologies helpful in the modern life (Table 2).

Table 2. Physicians' digital literacy and the aspects of this field.

Item	Yes		Rather Yes		No opinion		Rather no		No	
	N	%	N	%	N	%	N	%	N	%
I feel prepared to use e-Health solutions in my work	77	25.1	139	45.3	40	13.0	48	15.6	3	1.0
I would use training courses to improve my digital literacy	97	31.6	161	52.4	28	9.1	20	6.5	1	0.3
Current physician education keeps pace with the digital challenges of the 21st century	45	14.7	50	16.3	80	26.1	116	37.8	16	5.2
There should be more subjects that shape digital literacy in medical studies	80	26.1	153	49.8	43	14.0	30	9.8	1	0.3
The Internet will revolutionize healthcare in the near future	123	40.1	116	37.8	52	16.9	12	3.9	4	1.3

To verify how the frequency of using the Internet and the number of patients seen on average per month affect digital literacy, and other e-Health variables, the appropriate analyses have been carried out. It was shown that the frequency of using the Internet had a significant impact on the discussed indicators. Respondents who used the Internet every day (-0.22) or several times a day (-0.09) had higher digital skills ($F = 13.167$; $p = 0.0001$). Physicians using the Internet several times a day indicated a greater need for digital training (0.20). It was also shown that the more frequent the use of the Internet, the higher the assessment of the impact of the Internet and new technologies on healthcare and modern life ($F = 11.448$; $p = 0.0001$). A higher level of recommendation of e-Health solutions concerned physicians using the Internet several times a day (-0.17) than other respondents, using the Internet less frequently ($F = 7.045$; $p = 0.0001$). E-Health solutions in relation to the patient were also rated higher ($F = 37.800$; $p = 0.000$) by physicians using the Internet several times a day (-0.25) or daily (-0.06). It was noticed that the evaluation of e-Health solutions in relation to the medical facility was higher ($F = 3.343$; $p = 0.0107$) in respondents who used the Internet once a week (-0.79) or did not use it at all (-0.22). The impact of the Internet and new technologies on healthcare and the modern life was rated higher ($F = 5.371$; $p = 0.0013$) by physicians who saw less than 50 patients per month (-0.35), and with the number of patients admitted that the assessment of the impact of the Internet on healthcare decreased. It was also noticed that professionals who have seen less than 50 patients per month recommended more ($F = 5.432$; $p = 0.0012$) e-Health solutions (-0.34), and rated e-Health solutions higher ($F = 5.163$; $p = 0.0017$) in the relation to a medical facility (-0.42) (Table 3).

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 5 October 2022 doi:10.20944/preprints202210.0026.v1

Table 3. Correlations between: the frequency of Internet use and the number of patients seen on average per month by physicians, and digital and e-Health selected variables.

	Digital literacy – own skills		Digital literacy – the need for training		The impact of the Internet / new technologies on healthcare and modern life		Recommendation of e-Health solutions		Evaluation of e-Health solutions - the patient		Evaluation of e-Health solutions - medical facility	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
The frequency of Internet use												
several times a day	-0.09	0.93	0.20	0.91	-0.14	0.97	-0.17	0.92	-0.25	0.66	0.02	0.92
everyday	-0.22	0.76	-0.10	0.95	-0.07	0.93	0.17	1.05	-0.06	0.96	0.14	0.99
several times a week	0.11	0.60	-0.86	0.99	0.31	0.67	0.22	1.02	0.67	1.24	0.21	1.34
once a week	1.27	1.19	-0.58	1.14	0.91	0.54	0.88	0.89	1.66	1.08	-0.79	0.91
no use	1.36	1.83	-1.48	0.89	1.70	1.28	0.81	1.43	2.22	1.66	-0.22	1.76
	F	*p*	F	*p*	F	*p*	F	*p*	F	*p*	F	*p*
	13.167	0.0000	12.133	0.0000	11.448	0.0000	7.045	0.0000	37.800	0.0000	3.343	0.0107
The number of patients seen on average per month												
<50	0.01	1.09	-0.05	1.02	-0.35	0.89	-0.34	1.22	0.07	1.29	-0.42	0.65
50-100	-0.04	0.95	0.21	0.64	-0.23	0.85	0.28	0.75	-0.05	0.72	0.11	0.87
100-200	0.07	0.91	-0.04	1.34	0.17	1.00	0.23	1.01	0.40	1.15	0.44	1.22
>200	0.01	1.03	-0.10	1.06	0.19	1.06	-0.13	1.02	-0.08	1.00	-0.06	1.05
	F	*p*	F	*p*	F	*p*	F	*p*	F	*p*	F	*p*
	0.102	0.9587	1.873	0.1341	5.371	0.0013	5.432	0.0012	2.371	0.0705	5.163	0.0017

It was also checked how the frequency of using selected devices (in private life and at work) affects digital literacy, impact assessment, recommendation, and evaluation of e-Health solutions by physicians. It has been noticed, that there were statistically significant differences between the use of a computer in private and professional life and digital literacy (both skills and training needs). Respondents who frequently use the computer in their private life had a higher index of digital skills ($F = 9.480$; $p = 0.0000$). A similar relation was made with the use of a computer at work ($F = 17.886$; $p = 0.0000$). Physicians who used the computer less frequently in their private life or work had lower digital literacy in terms of skills (obtained higher scores, therefore their skills were lowered). Another statistically significant relation has been recognised indicating that respondents who often used a tablet, smartphone, e-mail, and mobile applications in their private or professional life, also had higher digital literacy in terms of skills. The impact of the frequency of computer use on digital literacy, assessment of the Internet impact, recommendation of e-Health solutions and assessment of these solutions (in relation to the patient) was also statistically significant. Respondents who frequently use the computer (both in private and professional life) also saw a greater need for training in the field of digital literacy, rated the impact of the Internet and new technologies on healthcare and a modern life higher, recommended e-Health solutions more often and rated higher e-Health solutions in relation to the patient (Table 4). The above results answer the research question Q.1. (More analyses confirming the above results can be found in the File S3_Table 1).

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 5 October 2022 doi:10.20944/preprints202210.0026.v1

Table 4. Correlations between digital and e-Health variables depending on using devices in physicians' private and professional life.

	computer		tablet		smartphone		e-mail		mobile apps	
In private life										
	F	*p*	F	*p*	F	*p*	F	*p*	F	*p*
Digital literacy – own skills	9.480	0.0000	7.406	0.0001	3.506	0.0158	6.276	0.0004	8.420	0.0000
Digital literacy – the need for training	9.817	0.0000	1.580	0.1941	27.609	0.0000	14.514	0.0000	21.495	0.0000
The impact of the Internet / new technologies on healthcare and modern life	8.357	0.0000	9.068	0.0000	10.420	0.0000	11.179	0.0000	26.757	0.0000
Recommendation of e-Health solutions	9.241	0.0000	8.609	0.0000	6.229	0.0004	12.670	0.0000	10.941	0.0000
Evaluation of e-Health solutions - the patient	20.095	0.0000	16.166	0.0000	22.946	0.0000	43.822	0.0000	30.692	0.0000
Evaluation of e-Health solutions - medical facility	0.540	0.6550	2.606	0.0519	1.766	0.1536	5.141	0.0018	2.764	0.0421
At work										
Digital literacy – own skills	17.886	0.0000	11.169	0.0000	5.831	0.0007	19.753	0.0000	6.240	0.0004
Digital literacy – the need for training	7.165	0.0001	2.059	0.1057	10.942	0.0000	12.404	0.0000	16.157	0.0000
The impact of the Internet / new technologies on healthcare and modern life	19.639	0.0000	2.606	0.0519	11.731	0.0000	8.553	0.0000	6.962	0.0002
Recommendation of e-Health solutions	6.141	0.0005	3.878	0.0096	10.026	0.0000	12.827	0.0000	8.529	0.0000
Evaluation of e-Health solutions - the patient	26.764	0.0000	2.533	0.0571	16.946	0.0000	28.404	0.0000	10.060	0.0000
Evaluation of e-Health solutions - medical facility	2.396	0.0683	2.172	0.0913	0.491	0.6890	1.795	0.1481	0.875	0.4543

There were no significant differences between gender and the values of selected e-Health indicators, however, it was shown, that with the age of surveyed physicians, digital skills decreased significantly, as well as the need for training. Moreover, the older the respondent, the lower the assessment of the impact of the Internet and new technologies on healthcare and the modern life, the recommendations of e-Health solutions, and the evaluation of e-Health solutions in relation to the patient. With physicians' age, the assessment of e-Health solutions related to running a medical facility increased (File S3_Table 2).

3.4. Physicians' opinion about online health information (Dr Google)

Every third physician (33.2%) acknowledged that more than 10% of her/his patients access health information on the Internet within a month. In their opinion such information were most often perceived as sometimes reliable (53.4%). 34.5% of physicians admitted that their patients sometimes experienced health benefits from accessing material on the Internet; 23.8% considered it to be rare. But generally, clinicians assessed negatively (41.7%) the effects of using the Internet-based health knowledge by their patients, which partially answers to research question Q.2. (File S2_Table 3-11).

3.5. Dr Google and physicians' digital literacy indicators

A greater need for training (lower digital literacy in this area) was demonstrated by physicians who stated that less than 1% of their patients access online health information (0.55). At the same time, these clinicians rated e-Health solutions higher than others (-0.38) in relation to the patient. The generally reliable online health information assessed mainly by physicians who rated the impact of the Internet and new technologies higher (-0.82), recommended e-Health solutions (-1.52), and rated e-Health solutions higher related to the patient (-0.85). Respondents who did not have an opinion on the quality of online health information were less interested in digital training (-0.44) and rated e-Health solutions higher in relation to a medical facility (-0.53). Physicians who claimed that patients often experienced health benefits from accessing online health information

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 5 October 2022 doi:10.20944/preprints202210.0026.v1

showed higher digital skills (-1.06), rated the impact of the Internet on healthcare higher (-0.50), recommended e-Health solutions more (-1.53), and rated e-Health solutions higher (-0.84). Respondents who said that their patients had never experienced health benefits from online health information had a higher need for digital training (0.98). Physicians who very positively assessed the effects of patients' use of online health knowledge had greater digital skills (-0.62). Those who assessed the effects negatively were the least likely to have a digital training. Respondents who very positively assessed the effects of patients using online health knowledge at the same time rated the impact of the Internet on healthcare higher (-0.52), recommended e-Health solutions (-1.52), and rated e-Health solutions higher in relation to the patient (-0.72). Physicians who negatively determined the effects of patients using online health knowledge at the same time rated e-Health solutions in relation to a medical facility (0.21) (Table 4). (More analyses between type of workplace can be found in the File S3_Table 11-12).

Table 4. Correlations between: % of patients accessing online health information within a month, Opinion about the general quality of online health information, and Opinion on patients' experience of health benefits as a result of access to online health information, and digital and e-Health variables.

	Digital literacy - own skills		Digital literacy - the need for training		Assessment of the impact of the Internet / new technologies on healthcare and modern life		Recommendation of e-Health solutions		Evaluation of e-Health solutions – the patient		Evaluation of e-Health solutions - medical facility	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
% of patients accessing online health information within a month												
< 1%	-0.08	1.62	0.55	1.20	-0.31	0.83	-0.48	1.28	-0.38	0.69	-0.04	0.59
1-2%	-0.02	1.15	0.03	1.05	0.12	0.72	-0.15	1.51	0.48	1.30	-0.01	1.34
3-5%	-0.10	1.08	-0.15	0.70	-0.06	0.87	-0.01	0.95	-0.07	0.76	0.15	0.88
6-10%	0.03	0.89	-0.04	1.02	0.12	0.99	0.12	0.99	0.15	1.18	0.11	1.32
> 10%	-0.14	0.70	0.27	0.91	-0.18	1.02	-0.07	0.84	-0.31	0.76	-0.09	0.77
it is difficult to estimate	0.25	1.15	-0.32	1.12	0.22	1.11	0.14	1.03	0.30	1.13	-0.03	1.11
Opinion about the general quality of online health information												
reliable	-1.00	1.07	0.06	0.93	-0.82	0.43	-1.52	1.15	-0.85	0.44	-0.16	0.76
usually reliable	-0.08	1.08	-0.28	0.87	-0.04	0.72	-0.29	0.89	-0.14	0.79	0.01	0.91
sometimes reliable	-0.07	0.83	0.10	0.95	-0.05	1.04	0.04	0.98	-0.07	0.79	0.15	1.03
unreliable	0.19	1.10	0.13	1.22	0.13	0.97	0.18	0.92	0.19	1.30	-0.23	0.90
no opinion	0.74	1.18	-0.44	0.94	0.54	1.31	0.67	0.68	0.75	1.59	-0.53	1.11
Opinion on patients' experience of health benefits as a result of access to online health information												
often	-1.06	0.83	0.18	0.86	-0.50	0.57	-1.53	0.86	-0.84	0.39	-0.23	0.81
sometimes	0.00	0.64	0.04	0.98	-0.16	0.86	-0.30	0.79	-0.27	0.72	-0.05	0.94
seldom	-0.14	0.93	0.13	1.13	0.07	1.15	0.13	0.95	-0.06	1.08	0.03	1.05
never	0.65	1.10	0.98	1.08	0.57	0.89	1.05	0.59	0.73	1.14	-0.27	0.84
no opinion	0.19	1.23	-0.29	0.82	0.12	1.04	0.34	0.94	0.37	1.06	0.10	1.08
An assessment of patients' use of online health knowledge												
very positive	-0.62	1.30	-0.10	0.99	-0.52	0.89	-1.51	1.14	-0.72	0.59	-0.11	0.77
positive	0.09	1.00	-0.09	0.66	0.13	0.95	-0.23	0.91	-0.12	0.66	-0.21	0.70
meaningless	-0.24	0.99	-0.01	1.08	-0.31	0.98	-0.21	1.10	-0.20	1.06	-0.17	0.97
negative	0.02	0.92	0.21	1.03	-0.01	0.82	0.19	0.85	0.04	0.96	0.21	1.08
very negative	0.31	1.07	-0.44	1.01	0.42	1.35	0.34	0.96	0.46	1.23	-0.05	1.07

The percentage of patients accessing online health information within a month was a variable that significantly correlated with the need for training in physicians' digital literacy, and the assessment of e-Health solutions in relation to the patient. The physicians'

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 5 October 2022 doi:10.20944/preprints202210.0026.v1

opinion about the overall quality of online health information correlated significantly with all other variables related to digital literacy and e-Health indicators, as well as the opinion on patients' health benefits of online materials did, with one exception regarding the assessment of e-Health solutions in relation to medical facility. On the other hand, the assessment of the effects of using the Internet-based health knowledge by patients fully correlated with all the indicated variables (Table 5). The above results answer the research question Q.2.

Table 5. Correlation matrix of selected variables.

	% of patients accessing online health information within a month		An opinion on the overall quality of online health information		An opinion on patients' health benefits related to online health information		An assessment of patients' use of online health knowledge	
	F	*p*	F	*p*	F	*p*	F	*p*
Digital literacy – own skills	1.541	0.1769	6.709	0.0000	7.845	0.0000	3.167	0.0143
Digital literacy – the need for training	4.262	0.0009	2.781	0.0270	6.066	0.0001	3.985	0.0036
The impact of the Internet / new technologies on healthcare and modern life	1.891	0.0956	3.776	0.0052	3.309	0.0113	4.754	0.0010
Recommendation of e-Health solutions	1.173	0.3225	11.079	0.0000	24.239	0.0000	10.246	0.0000
Assessment of e-Health solutions - the patient	5.193	0.0001	6.130	0.0001	11.394	0.0000	4.726	0.0010
Assessment of e-Health solutions - medical facility	0.517	0.7635	3.358	0.0104	0.760	0.5520	2.546	0.0396

3.6. Recommendation of e-Health solutions

Physicians most often recommended their patients to obtain laboratory test results (32.2%) and to arrange medical appointments via the Internet (27.0%). The willingness to recommend was mainly (72.3%) related to the use of mobile applications reminding about the need to take medications. Doctors did not recommend applications facilitating the analysis of test results (48.9%), did not recommend video consultation (46.3%) and were not in favour of remote monitoring of vital parameters (44.0%) (Table 7). The above results answer the research question Q.3.

Table 7. Types of E-Health solutions recommended by physicians.

e-Health Solution	**I have already recommended**		**I would recommend**		**I do not recommend**	
	N	**%**	**N**	**%**	**N**	**%**
Remote monitoring of basic parameters (pressure, heart rate, temperature, glucose level)	45	14.7	127	41.4	135	44.0
Obtaining laboratory test results via the Internet	99	32.2	163	53.1	45	14.7
Arranging medical appointments via the Internet	83	27.0	143	46.6	81	26.4
Using a mobile application – the analysis of tests results	47	15.3	110	35.8	150	48.9
Using the mobile application – a knowledge base on health-related topics	41	13.4	151	49.2	115	37.5
Using the mobile application – a mobile drug database	48	15.6	146	47.6	113	36.8
Using a mobile application – reminder to take medication	41	13.4	222	72.3	44	14.3
Using a video consultation with the doctor /nurse /midwife to support the treatment process	33	10.7	132	43.0	142	46.3

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 5 October 2022 doi:10.20944/preprints202210.0026.v1

3.7. Evaluation of e-Health solutions

The most important e-Health solutions considered by physicians were: using the electronic database of medicines (48.2%), solutions facilitating the sending / exchange of clinical results (46.6%), the possibility of writing out electronic sick leaves (44.6%), as well as easy and quick access to the patient's medical records in electronic form (42.0%) (Table 8). The above results answer the research question Q.4.

Table 8. Physicians' opinion about selected e-Health solutions.

	Very important		Important		Not very important		Insignificant		No opinion	
	N	%	N	%	N	%	N	%	N	%
Quick and easy access to the patient's medical records in electronic form	129	42.0	127	41.4	31	10.1	6	2.0	14	4.6
The possibility to write electronic prescriptions	112	36.5	132	43.0	33	10.7	6	2.0	24	7.8
The possibility to write out electronic sick leaves	137	44.6	132	43.0	18	5.9	11	3.6	9	2.9
The possibility to write electronic referrals	112	36.5	141	45.9	31	10.1	8	2.6	15	4.9
Using the electronic database of medicines	148	48.2	128	41.7	13	4.2	2	0.7	16	5.2
The ability to remotely route patients to other specialists or hospitals	106	34.5	129	42.0	38	12.4	9	2.9	25	8.1
The solutions to streamline the sending / sharing clinical results	143	46.6	113	36.8	24	7.8	8	2.6	19	6.2
Solutions enabling remote patient care	87	28.3	84	27.4	44	14.3	45	14.7	47	15.3
More digital solutions supporting the treatment and self-monitoring of the patient's health	70	22.8	143	46.6	46	15.0	13	4.2	35	11.4
The possibility to exercise comprehensive control over facilities, tracking generated costs, managing staff (schedules, schedules)	72	23.5	131	42.7	46	15.0	15	4.9	43	14.0
The possibility to conduct scientific research	96	31.3	120	39.1	26	8.5	18	5.9	47	15.3

3.8. Correlation matrix of all digital indicators

It has been shown that along with the deterioration of digital skills, the assessment of the impact of the Internet and new technologies on healthcare decreased ($r = 0.447$; $p = 0.000$), as well as the recommendation of e-Health solutions ($r = 0.413$; $p = 0.000$), and the assessment of e-Health solutions for the patient ($r = 0.449$; $p = 0.000$). The lower the need for training in digital literacy, the higher the assessment of the impact of the Internet and new technologies on healthcare ($r = -0.239$; $p = 0.000$), the recommendation of e-Health solutions ($r = -0.131$; $p = 0.000$), and the assessment of e-Health solutions in relation to the patient ($r = -0.250$; $p = 0.000$). The lower the assessment of the impact of the Internet and new technologies on healthcare, the lower the recommendation of e-Health solutions ($r = 0.369$; $p = 0.000$), and the rating of e-Health solutions ($r = 0.457$; $p = 0.000$). It was also found that the lower the recommendation of e-Health solutions, the lower the evaluation of e-Health solutions for the patient ($r = 0.588$; $p = 0.000$), and for the medical facility ($r = 0.140$; $p = 0.000$) (Table 6).

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 5 October 2022 doi:10.20944/preprints202210.0026.v1

Table 6. Correlation matrix of all digital and e-Health indicators.

		Digital literacy – need for training	The impact of the Internet / new technologies on healthcare and modern life	Recommendation of e-Health solutions	Assessment of e-Health solutions - the patient	Assessment of e-Health solutions - medical facility
Digital literacy – own skills	r	0.000	0.447	0.413	0.449	-0.105
	p	1.0000	0.0000	0.0000	0.0000	0.0673
Digital literacy – need for training	r		-0.239	-0.131	-0.250	0.040
	p		0.0000	0.0220	0.0000	0.4883
The impact of the Internet / new technologies on healthcare and modern life	r			0.369	0.457	0.022
	p			0.0000	0.0000	0.7029
Recommendation of e-Health solutions	r				0.588	0.140
	p				0.0000	0.0144
Assessment of e-Health solutions - the patient	r					0.000
	p					1.0000

r - Pearson correlation coefficient

4. Discussion

We live in a world of rapid technological, demographic and social changes, in which digitization has become a factor of advantage and an element of the competitiveness of economies and systems. Also those in the field of health. These changes are becoming a fact that needs to be documented in various aspects: technological, human, qualitative, financial, etc. Especially that in the case of Poland and many other countries in the region, the development and popularization of digital e-Health services is a priority direction for the development of the local health care system [25].

Our purpose in this study was to investigate physicians' self-digital literacy and analyze their perception of online health knowledge obtained by patients, and identify attitudes towards e-Health solutions. It was also important to characterize and describe the phenomenon of Dr. Google, which affects the existing doctors-patients' relationships, and shapes the modern understanding of health information.

In general, the majority of 307 physicians participated in the study were familiar with new technologies. Both in their private and professional life they use a smartphone (83.4% vs. 47.6%), a computer (65.8% vs. 85.0%), and e-mail (70.7 % vs. 30.9%). Respondents reported using the Internet mainly several times a day (66.8%) or every day (19.9%) which does not differ significantly from the statistics in previous studies [12, 19, 26-28]. In the "Internet in the life of Poles" report commissioned by the Ministry of Digitization in June 2019, the professional group most willing to use the Internet and e-services were physicians [29].

A similar situation applied to the skills to use e-Health – clinicians described them as very good (33.6%) or good (32.6%). Moreover our study has demonstrated that the more intensive the Internet use, the higher digital skills ($F = 13.167$; $p < 0.0001$). However, according to the CPME Policy on Digital Competencies for Doctors, neither the practicing health professionals nor the generation in training are adequately prepared and there is still a gap between understanding how digital solutions may support their capabilities, and actual use of them [21].

In this context interesting results were obtained in our research: although 70% of respondents felt prepared to support e-Health solutions, still a significant percentage (84%) reported the need for additional training or courses in the field of shaping digital skills. Additionally, the more the use of electronic devices (computer, tablet, smartphone,

 doi:10.20944/preprints202210.0026.v1

e-mail and mobile apps), a greater need for training in the field of digital literacy was reported. The study prepared for the European Parliament confirms these fears: of the participants that received digital skills training, 54% rated it as insufficient. A survey of more than 200 physicians found that a large majority (80%) of the questioned professionals indicated that the currently available e-Health/m-Health training is inadequate [30]. Especially since digital skills have been shown to deteriorate with the age of surveyed physicians. These are important findings, especially according to the dominant opinion (77.9%) among physicians that the Internet would revolutionize modern healthcare. The awareness of the importance of digitization in the case of the surveyed doctors was connected with the explicit doubt whether the educational programs in medical studies follow the technological challenges of the 21st century. It is a paradox that in times of an unprecedented technological boom, medical education in this field is still insufficient, what multiplicity studies from different countries have reported [31-33]

The use of the Internet for health porpoise is increasing, but its impact on healthcare is still unclear. Undeniably seeking health information online will keep increasing [34]. People indicate the Internet as the first source of health information primarily because of limited time consultation and barriers to accessing professional health services [35]. However, how the above translates into interaction: physician-the Web-patient? Cocco et al found that seeking online health information by patients had positive effects on the doctor-patient relationship, and improve their communication. But at the same time it was noticed, that the Internet-sourced information did cause some anxiety for 40% of searchers [36].

Polish Internet users most often (almost 59%) pointed that data they can find on the Internet does not require leaving home. Almost equally important (53%) was the opportunity to find the information 24/7. Another reason indicated by 32% of respondents was to supplement the information that they did not receive during a medical visit. Thanks to the information obtained earlier, almost 25% of respondents felt better prepared to visit a doctor. The next places were: the possibility of finding information that is not elsewhere (23%), anonymity (20%) or the ability to contact other people in a similar situation (16%) [37]. Based on the national survey conducted in 2013 by the Pew Research Center's Internet & American Life Project, 1 in 3 American adults said they went online to determine their medical condition, and 35% of the respondents said they do not need any professional opinion [16]. In our study every third physician (33.2%) acknowledged that more than 10% of her/his patients access health information on the Internet within a month. Physicians questioned by Murray et al. in 85% claimed had experienced a patient bringing Internet information to a visit [11]. The quality assessment of this information in physician's opinion in our study was most often perceived as sometimes reliable (53.4%). Potts &, Wyatt came to similar conclusions, reporting that over two thirds of the questioned professionals considered online health information to be usually (20%) or sometimes (48%) reliable [38]. And again, data from our study showed that physicians who assessed the effects of using the online health knowledge by patients very positively, had greater digital skills, recommended e-Health solutions, and rated e-Health solutions higher. At the same time those who assessed the effects of the use of the Internet by patients negatively indicated the need for training in digital literacy. We did not check whether these results significantly affect the doctors-patients' relationship, but Murray et al. reported that physicians did have a impression that their authority was challenging because of Dr. Google [11]. Moreover, this reaction was associated with harms to the quality of care, health outcomes, and time efficiency. The results of other studies indicate that physicians' attitude to online health information seeking is critical [26], and they are not very familiar and confident with patients who 'Google' [39].

In the context of the recommending and assessment of e-health solutions, Polish physicians remained favourable, expressed a definite desire to recommend such solutions to their patients. It is a limitation that our study was conducted before the strongest influence of COVID-19 pandemic, which further shows the positive attitude of doctors to

 doi:10.20944/preprints202210.0026.v1

this type of solutions. Changes in digital health caused by a pandemic could change this aspect what should be investigating, but in their source, they refer to the educational role of a doctor who can have an active impact on improving the e-Health literacy of the patient, providing them with reliable and trustworthy recommendations of new technological solutions dedicated to health [13,40]. However, as our research showed, the lower digital skills of physician, the recommendation of e-health solutions decreased, and the assessment of e-Health solutions for the patient was reduced.

To sum up, the strategic importance of digital skills goes beyond the issue of short-term development of e-Health itself – it should be considered as a key factor of the development of conscious information society, both on the side of professionals and recipients of services. Not only in highly developed and developing countries. Smartphones, universal access to the Internet and mobile applications meeting patients' expectations are revolutionizing the sector. Telemedicine enters clinical practice, medical universities include e-Health in their curricula, and other countries are introducing legal regulations supporting digital health.

The issue of digitization in healthcare is often referred to a process depending only on the technology to which people should adapt. Digital reality, however, is not only the e-development, but the need of a holistic approach to the entire sector, organizational processes, legal regulations and standards that guarantee interoperability and cooperation between the physician, the Web and the patient.

5. Conclusions

This study provides some contribution to theory and practice. From the theoretical perspective, we explore the physicians' digital literacy, their opinion about Dr. Google - a phenomenon understood as searching and obtaining information on health via the Internet, and overall assessment of e-Health solutions. Our empirical study confirms that despite the highly rated digital skills, doctors reported the need for further training in addressing digital competences. Our research led to the conclusion that professionals and authors of curricula for medical studies should cooperate to develop consistent courses that meet today's digital challenges. Moreover, the results showed that physicians generally stay sceptical about online-sourced health knowledge obtained by their patients, but they do believe that Internet will revolutionize healthcare in the near future. Digital health technologies are changing the way healthcare is delivered, therefore, it seems that the educational potential and indicating to the patient which content dedicated to health is valuable and useful is one of the important tasks of a modern physician.

6. Limitations

This study had several limitations. First, the research relied on a self-designed questionnaire. At the stage of creating study, the available tools for measuring digital literacy should be included, however, in this case, we wanted to use specific sections in the questionnaire, and each construct was validated. Second, the study was conducted before COVID-19 pandemic, which is important for the interpretation of results obtained. There are scientific evidences that this global pandemic significantly accelerated the daily use of digital solutions in the health system [40-42]. According to the Deloitte report, almost 65% of the Polish health system employees indicated that in reaction to the COVID-19 pandemic, their institutions increased the use of digital technologies supporting physicians' work, and in the opinion of 64.3% respondents they were also used in remote support and contact with patients. At the same time, the use of digital solutions was most often mentioned by GPs (74.7%), who, due to the COVID-19, widely adopted the remote method of initial patient assessment [42]. This could has a positive impact on the attitude of physicians and patients towards eHealth solutions and should be the subject of further, post-pandemic research. Another limitation we acknowledge is that we interviewed physicians from one region in Poland which may have limited generalizability to the country and beyond. However, we gathered a large and diverse group of physicians of

various specialties, representative of the Podkarpackie Voivodeship. Future research may also look at individual medical specialties for deeper understanding of their perspectives. Finally, as the study is cross-sectional in nature, alternative relationships might also exist; thus, future research should be longitudinal.

Supplementary Materials: The following are available online at File S1: Questionnaire; File S2: Frequencies; File 3: Correlations.

Author Contributions: Conceptualization, J.B.; Data curation, J.B. and A.B.; Formal analysis, J.B. and A.B.; Investigation, J.B. and A.B.; Methodology, J.B.; Resources, J.B.; Supervision, P.J.; Writing—original draft, J.B. All authors have read and agreed to the published version of the manuscript.

Funding: The author received no financial support for the research, authorship, and/or publication of this article.

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Ethics Committee of Rzeszow University (protocol code 10/12/2019).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on reasonable request from the corresponding author. The data are not publicly available due to restrictions, e.g., their containing information that could compromise the privacy of research participants.

Ethical Approval: The study was approved by the institutional Bioethics Committee of the Rzeszow University (Resolution No. 10 December 2019) and all relevant administrative bodies.

Conflicts of Interest: The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

References

1. Digital 2022. Global Overview Report. Hootsuite, We are social. Available online: https://www.hootsuite.com/resources/digital-trends (accessed: 26 September 2022).

2. Wald, H.; Dube, C.; Anthony, D. Untangling the Web: The impact of Internet use on health care and the physician–patient relationship. *Patient Educ Couns*. **2007**, 68, 218–224.

3. Huisman, M.; Joye, S.; Biltereyst, D. Searching for Health: Doctor Google and the Shifting Dynamics of the Middle-Aged and Older Adult Patient–Physician Relationship and Interaction. *Journal of Aging and Health* **2020**, 32(9), 998-1007. doi:10.1177/0898264319873809

4. Davis, J.K. Dr. Google and Premature Consent: Patients Who Trust the Internet More Than They Trust Their Provider. *HEC Forum* **2018**, 30, 253–265. doi: https://doi.org/10.1007/s10730-017-9338-z

5. Sbaffi, L.; Rowley, J. Trust and Credibility in Web-Based Health Information: A Review and Agenda for Future Research. *J Med Internet Res*. **2017**, 19, 19(6): e218. doi: 10.2196/jmir.7579.

6. Pitt, M.B.; Hendrickson, M.A. Providing a Second Opinion to Dr. Google with the WWW Framework. *J GEN INTERN MED* **2022**, 37, 222–224. doi: https://doi.org/10.1007/s11606-021-06895-2

7. Cacciamani, G.E.; Dell'Oglio, P.; Cocci, A.; Russo, G.I.; De Castro Abreu A.; Gill, I.S.; Briganti, A.; Artibani W. Asking "Dr. Google" for a Second Opinion: The Devil Is in the Details. *European Urology Focus* **2021**, 7(2), 479-481. doi:10.1016/j.euf.2019.10.011

8. Van Riel, N.; Auwerx, K.; Debbaut, P.; Van Hees, S.; Schoenmakers, B. The effect of Dr Google on doctor-patient encounters in primary care: a quantitative, observational, cross-sectional study. *BJGP Open* **2017** 17;1(2):bjgpopen17X100833. doi: 10.3399/bjgpopen17X100833

9. Tustin, N. The role of patient satisfaction in online health information seeking. *J Health Commun* **2010**, 15(1), 3-17.

10. Attfield, S.J.; Adams, A.; Blandford, A. Patient information needs: pre- and post-consultation. *Health Informatics J* **2006**, 12(2), 165-177.

11. Murray, E.; Lo, B.; Pollack, L.; Donelan, K.; Catania, J.; White, M.; et al. The impact of health information on the internet on the physician-patient relationship: patient perceptions. *Arch Intern Med* **2003**, 28, 163(14),1727-1734.

12. Wald, H.S.; Dube, C.E.; Anthony, D.C. Untangling the Web - the impact of Internet use on health care and the physician-patient relationship. *Patient Educ Couns* **2007**, 68(3), 218-224.

13. Woodward-Kron, R.; Connor, M.; Schulz, P.J.; Elliott, K. Educating the Patient for Health Care Communication in the Age of the World Wide Web: A Qualitative Study. *Academic Medicine* **2014**, 89(2), 318-325 doi: 10.1097/ACM.0000000000000101

14. Powell, J.; Inglis, N.; Ronnie, J.; Large, S. The Characteristics and Motivations of Online Health Information Seekers: Cross-Sectional Survey and Qualitative Interview Study. *J Med Internet Res* **2011**, 13(1), e20.

15. Lee, K.; Hoti, K.; Hughes, J.D.; Emmerton, L. Dr Google Is Here to Stay but Health Care Professionals Are Still Valued: An Analysis of Health Care Consumers' Internet Navigation Support Preferences. *J Med Internet Res* **2017**, 19(6), e210. doi: 10.2196/jmir.7489.

16. Fox, S.; Duggan, M. Pew Research Center. Health Online **2013**. Available online: https://www.pewinternet.org/wp-content/uploads/sites/9/media/Files/Reports/PIP_HealthOnline.pdf (accessed: 26 September 2022).

17. Caiata-Zufferey, M.; Abraham, A.; Sommerhalder, K.; Schulz, P.J. Online health information seeking in the context of the medical consultation in Switzerland. *Qual Health Res* **2010**, 20(8):1050–61. doi: 10.1177/1049732310368404.

18. Hunter, D.J.; Longo, D.L. The Precision of Evidence Needed to Practice. *N Engl J Med* **2019**, 20, 380(25), 2472-2474.

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

20. European Commission. European Skills Agenda for sustainable competitiveness, social fairness and resilience. COM(2020) 274 final, July **2020**. Available online: https://www.europarl.europa.eu/doceo/document/TA-9-2021-0051_EN.html (accessed: 26 September 2022).

21. CPME Policy on Digital Competencies for Doctors' (CPME 2020/100 FINAL). **2020**. Available online: https://www.cpme.eu/api/documents/adopted/2020/11/CPME_AD_Board_21112020_100.FINAL_.CPME_.Policy.Digital.Competencies.for_.Doctors.pdf (accessed: 26 September 2022).

22. European Commission. Flash Eurobarometer 404 (European Citizens' Digital Health Literacy), Gesis Data Archive **2015**, v.1. Available online: http://ec.europa.eu/commfrontoffice/publicopinion/flash/fl_404_sum_en.pdf (accessed: 26 September 2022).

23. Bawden, D. Information and digital literacies: a review of concepts. *Journal of Documentation* **2001**, 57(2), 218–259.

24. Bartosiewicz, A.; Burzyńska, J.; Januszewicz, P. Polish Nurses' Attitude to e-Health Solutions and Self-Assessment of Their IT Competence. *J. Clin. Med*. **2021**, 10, 4799. doi: https://doi.org/10.3390/jcm10204799

25. Zdrowa Przyszłość. Ramy strategiczne rozwoju systemu ochrony zdrowia na lata 2021–2027, z perspektywą do 2030 r. Ministerstwo Zdrowia. Available online: https://www.gov.pl/web/zdrowie/zdrowa-przyszlosc-ramy-strategiczne-rozwoju-systemu-ochrony-zdrowia-na-lata-2021-2027-z-perspektywa-do-2030 (accessed: 26 September 2022).

26. Van Riel, N.; Auwerx, K.; Debbaut, P.; Van Hees, S.; Schoenmakers, B. The effect of Dr Google on doctor–patient encounters in primary care: a quantitative, observational, cross-sectional study. *BJGP Open* **2017**; 1 (2), bjgpopen17X100833. DOI: 10.3399/bjgpopen17X100833

27. Liu, L.; Wei, K.; Zhang, X.; Wen, D.; Gao, L.; Lei, J. The Current Status and a New Approach for Chinese Doctors to Obtain Medical Knowledge Using Social Media: A Study of WeChat, *Wireless Communications and Mobile Computing* **2018**, 2329876,10. doi: https://doi.org/10.1155/2018/2329876

28. Parlakkılıç, A. Evaluation of Physicians' Information Technology Readiness. *Euras J Fam Med* **2020**, 9(3): 170-5. doi:10.33880/ejfm.2020090308

29. Internet in the life of Poles. Ministry of Digitization. **2019**. Available online: https://www.gov.pl/web/cyfryzacja/internet-ulatwia-zycie-polakom (accessed on 22 August 2022).

30. European Health Parliament. Committee on digital skills for health professionals. **2020**. Available online: https://www.healthparliament.eu/wp-content/uploads/2017/09/Digital-skills-for-health-professionals.pdf (accessed: 22 August 2022).

31. Han, E.R.; Yeo, S.; Kim, M.J.; et al. Medical education trends for future physicians in the era of advanced technology and artificial intelligence: an integrative review. *BMC Med Educ.* **2019**, 19(1), 460.

32. Nazeha, N.; Pavagadhi, D.; Kyaw, B.M.; et al. A digitally competent health workforce: scoping review of educational frameworks. *J Med Internet Res*. **2020**, 22(11), e22706.

33. Foadi ,N.; Varghese, J. Digital competence - A Key Competence for Todays and Future Physicians. *J Eur CME* **2022**, 2, 11(1), 2015200. doi: 10.1080/21614083.2021.2015200.

34. Thapa, D.K.; Visentin, D.C.; Kornhaber, R.; West, S.; Cleary, M. The influence of online health information on health decisions: A systematic review. *Patient Education and Counseling* **2021**, 104, 4: 770-784.

35. Chu, J.T.; Wang, M.P.; Shen, C.; Viswanath, K.; Lam, T.H.; Chan, S.S.C. How, When and Why People Seek Health Information Online: Qualitative Study in Hong Kong. *Interact J Med Res.* **2017**, 12, 6(2): e24. doi: 10.2196/ijmr.7000.

36. Cocco, A.M.; Zordan, R.; Taylor, D.M.; et al. Dr Google in the ED: searching for online health information by adult emergency department patients. *Med J Aust* **2018**; 209: 342-347.

37. Doroszewska, A. Wpływ Internetu na zachowania w zdrowiu i chorobie. In: *Zdrowie i choroba w kontekście psychospołecznym*. Popielski, K., Skrzypek, M., Albińska, E. Publisher: Wydawnictwo KUL, Lublin, 2010, pp. 299-311.

38. Potts, H.W.W.; Wyatt, J.C. Survey of Doctors' Experience of Patients Using the Internet. *J Med Internet Res*. **2002**, 4(1): e5 doi: 10.2196/jmir.4.1.e5.

39. Lewis, S.P.; Mahdy, J.C.; Michal, N.J.; et al. Googling Self-injury: the state of health information obtained through online searches for self-injury. *JAMA Pediatr*. **2014**, 168(5): 443–449. doi:10.1001/jamapediatrics.2014.187.

40. Niedźwiedziński, M.; Klepacz, H. The Digitization of Health Care as a Weapon in the Fight against the COVID-19 Pandemic. *Przedsiębiorczość i Zarządzanie* **2021**, 12(4), 81-99.

41. Abd-Alrazaq, A.; Alajlani, M.; Alhuwail, D.; Schneider, J.; Al-Kuwari, S.; Shah, Z.; Hamdi, M.; Househ, M. Artificial Intelligence in the Fight Against COVID-19: Scoping Review. *Journal of Medical Internet Research* **2020**, 22, 12, DOI: 10.2196/20756.

42. Deloitte. Digital transformation: Shaping the future of European healthcare. 2020 Available online: https://www2.deloitte.com/pl/pl/pages/life-sciences-and-healthcare/articles/raport-Digital-transformation-Shaping-the-future-of-European-healthcare.html (accessed: 22 August 2022).