MEDICAL UNIVERSITY OF PLOVDIV
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STUDY AND COMPARATIVE ANALYSIS OF ATTITUDES TOWARDS ELECTRONIC HEALTHCARE IN BULGARIA

ABSTRACT

of a PhD Dissertation
for the award of a PhD educational and scientific degree
in the Medical Informatics doctoral programme
higher education area 7. Healthcare and Sport,
professional field 7.4. Public Health

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The dissertation contains 179 pages and has been illustrated with 39 tables, 30 figures and 17 appendices*. The references include 158 sources, 27 of which in the Cyrillic script and 131 in Latin.

The author works as an assistant professor in the Department of Medical Informatics, Biostatistics and E-Learning at the Faculty of Public Health of the Medical University – Plovdiv.

The dissertation was submitted for pre-defence before the extended departmental council of the Department of Medical Informatics, Biostatistics and E-Learning at the Medical University – Plovdiv on 20 April 2023 and has been authorised for defence.

The doctoral student was deregistered and approved for dissertation defence pursuant to Order No. R-1197 / 09.05.2023 of the Rector of the MU – Plovdiv, Prof. Dr. Mariana Murdzheva, MD, MHM.

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The dissertation has been authorised for defence before a scientific jury comprising the following members:

Internal members:

Prof. Bianka Tornyova, PhD

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External members:

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Reserve members:

Assoc. Prof. Todor Stoev, PhD

Assoc. Prof. Stefan Velikov, PhD

The public defence of the dissertation before a scientific jury will take place on 28.09.2023 at 11.00 AM in the Second Auditorium of the Auditorium Complex of the Medical University – Plovdiv, 15A Vasil Aprilov Blvd., Plovdiv.

The materials for the defence have been submitted to the Scientific Department of the MU –Plovdiv, 15A Vasil Aprilov Blvd., and have been displayed on the website of the Medical University – Plovdiv.

* The numbers of figures and tables do not correspond to those of the dissertation work

CONTENTS

ABBREVIATIONS USED

OHS: other healthcare specialists
EH: electronic healthcare
EMD: electronic medical record
DHT: digital health technologies
MHA: mobile health applications
ICT: information and communication technologies
SD: specialist doctors
MH: Ministry of Health
MP: medical professionals
NM: nurses and midwives
NHIS: National Health Information System
NAGPB: National Association of General Practitioners in Bulgaria
GP: general practitioners

I. INTRODUCTION

Electronic healthcare is the latest and most modern field in healthcare worldwide. It is a priority, and has been the object of numerous European programmes aimed at building, developing and improving the exchange of health data, thereby increasing the quality of health services and healthcare. The rapidly advancing information and communication technologies provide enormous potential for the creation of healthcare applications.

The implementation of electronic healthcare contributes to the solution of a number of health, social and economic problems. Electronic healthcare is a collective term that includes a wide range of health services and medical care, including electronic health records, health information systems, remote health monitoring, telemedicine, telehealth, telecare, health data analysis, etc.

The introduction of information and communication technologies into the field of medicine in Bulgaria is associated with a number of expectations, and with a lot of questions, too. Along with the synchronisation, coordination and efficient communication between the institutions involved in the problem that are necessary for the introduction of electronic healthcare, for its successful operation and the provision of better quality services that meet public expectations, an information campaign accessible to the public and a survey of the public opinion are needed.

In order to make progress in the transition to digital health and the development of a system that prioritises people's health and well-being, their attitudes and motivations as users of e-health services must first be explored in order to better understand what drives consumers toward personalised approaches to health and well-being. It is no less important to examine the attitudes of the specialists in the health sector, who are institutionally obliged to use some functionalities of electronic healthcare.

Over the past two years, the Covid-19 pandemic has brought about changes in all areas of life. Although most of these changes have been in a negative direction, accelerated digitalisation is one of the positive consequences. The shift from physical to digital services not only provides convenience but also helps in the measures against the spreading of the virus. In Bulgarian healthcare spheres, digitisation is taking place at a slower pace, but more and more medical facilities are offering healthcare electronic services such as online booking of an appointment for examinations and consultations. A number of free mobile applications have been developed to combat COVID-19, including virus spread tracking and symptom tracking. The National Health Information System has

implemented a digital COVID certificate platform that complies with the requirements of the European Union.

As an effect of the pandemic situation and in response to the overload of the healthcare system, the Ministry of Health significantly accelerated the creation, development and implementation of functionalities in the National Health Information System – the basis of electronic healthcare in Bulgaria.

Electronic healthcare (EH) is a solution to lots of the problems of the modern health sector. It is progressively shifting its focus to understanding people and new care models. It mediates the transition from traditional institution-centred medicine to a consumer approach, ensuring the patients' commitment to prevention and care for their own health.

The users' attitude is of particular importance for the successful introduction of EH and the actual use of the services it offers. This necessitates a study of their attitudes, expectations and concerns that would reveal the factors affecting the use of EH services. The target groups emerging as EH users are medical professionals and the public, not only in their role of patients, but also as individuals concerned with the maintenance of their own health and well-being.

The clarification of a great part of these topical issues requires in-depth research and analysis of attitudes. The conclusions drawn have confirmed these observations and justified the need for conducting the present dissertation study.

II. AIMS AND OBJECTIVES

AIM

The main aim of this dissertation was to study and compare the attitudes of users of electronic healthcare in Bulgaria.

OBJECTIVES

The following main objectives were outlined for the purpose of achieving the aim set:

1. To investigate the expected benefits and concerns related to EH of the following target groups and to compare them:
   a) General Practitioners (GP)
   b) Specialty Doctors (SD)
   c) Nurses and Midwives (NM)
   d) Other Healthcare Specialists (OHS)

2. To investigate the public attitudes regarding the use of digital health technologies and their determining factors and dynamics in the course of the COVID-19 pandemic.

3. To analyse the expectations, attitudes and concerns of general practitioners regarding EH and their dynamics during the 2020 – 2022 period.

4. To investigate the impact of electronic healthcare and information technology on doctor-patient relationships.

III. MATERIAL AND METHODS

1. Object and subject of the study

The object of the study is the users of electronic healthcare. The subject of the study is electronic healthcare in Bulgaria and the attitudes towards its introduction.

2. Study design and organisation

Four cross-sectional surveys were conducted among the public and among healthcare specialists. The survey organisation and period have been presented in table 1.

Table 1. *Surveys conducted for the purpose of the dissertation*

name of the survey	*period of implementation*	*respondents*	*number of filled-out surveys*	*form of implementation*
Survey of public attitudes regarding COVID-19 and the use of digital health technologies related to it	04.2020 – 07.2020	the general public	162	online through Google forms
Survey of GPs' expectations, attitudes and concerns about electronic healthcare	10.2020	GP	66	paper-based
Survey of public attitudes towards the use of digital health technologies during the COVID-19 pandemic	04.2021 – 07.2021	the general public	147	online through Google forms
Survey of the medical professionals' attitudes towards electronic healthcare	04.2022 - 10.2022	GP SD NM OHS	225	online through Google forms; paper-based
Total number of results processed:	**600**			

3. Units of observation

The units of observation were as follows:

• Employees of Uni Hospital Multifunctional Active Treatment Hospital, town of Panagyurishte;

• GP, members of the National Association of General Practitioners in Bulgaria (NAGPB) and its Regional Structures;

• Randomly selected respondents who responded to an email invitation.

For each survey, the number of respondents has been quoted in table. 1.

4. Method

4.1. Documentary method

Information from the following documents has been used and cited in the dissertation:

- National Health Strategy for implementation of electronic healthcare in Bulgaria, 2006, Ministry of Health
- National Health Strategy 2008 – 2013 and Action Plan, Ministry of Health
- "Goals for Health 2020" Concept, Ministry of Health
- National Health Strategy 2020, Ministry of Health
- Regulation № H-6 of December 21, 2022 on the Functioning of the National Health Information System, Ministry of Health
- Audit Reports, 2017, Bulgarian National Audit Office
- National Classification of Professions and Positions in the Republic of Bulgaria – 2011, Ministry of Labour and Social Policy.

Information from the following institutional internet sites has been used and cited in the dissertation:

- Personalised Information System – PIS, NHIF (National Health Insurance Fund)
- National Health Information System, Ministry of Health

4.2. Survey method

Four surveys were conducted aimed at three target groups of respondents: two among the general public (in the role of patients and users of EH), medical professionals and general practitioners (table 1).

1. General Public

Due to the emergency situation caused by COVID-19, the focus of the surveys of the general public's attitudes about EH was also on the use of digital health technologies in a pandemic context. The two surveys were conducted in two consecutive years, online via Google Forms.

The first survey began with 9 statements about the pandemic emergency situation, whereby the respondents had to indicate their degree of agreement on a four-point Likert scale from "fully disagree" to "fully agree". Then 8 questions followed, 4 of which closed-ended and 4 multiple-choice. They referred to the changes that occurred in the respondents' professional lives as a result of the pandemic and the entry of digital technologies into their lives, as well as their attitudes towards the use of an online platform for COVID-19-related consultations, and the preferred sources of information about the virus. Next, there was a module with demographic data on gender, age and education, as well as self-reported characteristics of the respondents' computer skills, the frequency of Internet use and the frequency of use of functionalities such as e-mail, web, social networks and applications, e.g. Viber, Messenger and Skype.

The second survey contained 7 questions, 3 of which closed-ended and 4 multiple-choice. In terms of thematic content, when the survey form was developed, the information seeking question from the previous survey focused on the safest information dissemination ways that would allow existing COVID-19-related apps to reach users. A question assessing the users' interest in using mobile health applications (MHA) in a pandemic situation was also included, as well as the attitudes towards using online health services offered by medical institutions. The survey ended with a demographic module similar to the first form.

The questions common to both survey forms, the indicators according to which the respondents' attitudes during the pandemic were compared, were related to the use of digital health technologies (DHT) in emergency situations, the attitudes towards the use of applications and assistance from a 24/7 online platform with various functionalities related to COVID-19, and the preferred choice of receiving a medical consultation in a pandemic context.

2. General practitioners (2020)

The survey for the general practitioners (GP) included demographic data such as gender, age, place of work, professional experience, type of practice, average number of patients in the practice, as well as data on computer skills and internet use in the workplace.

The respondents were offered seventeen statements aimed at assessing their attitudes towards the usefulness and difficulties in the use of the EH components by the physicians, the benefit to patients, and the impact on the provision of healthcare. Separately from the table, an open-ended response box was included where the respondents could express their opinion regarding EH.

The next module dealt with “Mobile health applications and information and communication technologies (ICT) in practice” and contained nine questions aimed at exploring the types of ICT that the physicians applied in their practice and their attitudes towards using MHA.

The last panel in the survey referred to the use of health sites, forums and online health information. Again, a table of 10 statements was provided for the respondents to rate along a five-point Likert scale from "fully disagree" to "fully agree" with a neutral position included. Again, an open-ended response box was provided for the respondents to express their opinion on the subject matter of the panel.

3. Medical Professionals

The survey form designed to compare the attitudes of medical professionals (MP) towards EH included demographic data on the respondents, such as gender, age, working experience, specialty, self-reported computer skills, and Internet use. The potential positive effects and the obstacles to the introduction of EH were presented as statements in two separate panels, and the respondents had to rate them along a five-point Likert scale ranging from "fully disagree" to "fully agree". The next thematic module of the survey explored the types of remote health services that the respondents could access. Two closed-end questions were related to the use of MHA in the medical practice. The last panel in the survey explored the MPs’ attitudes to the patients regarding the manner in which they used the online health information and the frequency with which the respondents encountered the potential situations suggested.

4.3. Statistical methods

With regard to the main aim and objectives of the study, as well as the volume, type and distribution of the data in the course of the study, the following statistical methods were used:

a) Descriptive statistical methods

Descriptive statistical methods were used in each of the studies included in the dissertation. Qualitative non-numerical variables were represented by frequencies and proportions (n, %). Descriptive statistics were used in the analysis of the quantitative variables and the results were presented as mean ±SEM, standard deviation (SD) and 95% confidence interval (95% CI).

b) Parametric methods

- Student's independent-samples t-test was used to test hypotheses about the presence of a statistically significant difference between two normally distributed independent samples;
- One-way ANOVA and the Bonferroni test were used to compare more than two independent normally distributed samples.

c) Nonparametric methods

- The normality of the distribution of the studied variables was analysed using the Kolmogorov-Smirnov test;
- The χ^2 test was used for testing the hypothesis of non-significant (random) influence of a given factor;
- The Mann-Whitney U test was applied for comparing two independent samples with non-normal distribution;
- The Kruskal-Wallis test was applied for comparing more than two independent samples with non-normal distribution.

A significance level of $p<0.05$ was applied for all tests.

The software product IMB SPSSv.19 was used for statistical processing.

4.4. Graphical methods

Microsoft Excel 2016 and CorelDraw X6 were used for the graphical presentation of the results.

IV. RESULTS AND DISCUSSION

1. A survey of the attitudes of medical professionals

For the purpose of the study, the results were presented by dividing the respondents into four groups according to their specialisation, which was determined in conformity with the National Classification of Professions and Positions in the Republic of Bulgaria – 2011:

- General Practitioners (GP);
- Speciality Doctors (SD);
- Nurses and Midwives (NM);
- Other Healthcare Specialists (OHS)

In order to study the attitudes of GP, the survey was distributed online, via Google Forms, among the members of the National Association of General Practitioners in Bulgaria (NAGPB) and the regional structures of the NAGPB. A paper-based survey was used for the SD, NM and OHS, employees of the Uni Hospital Multifunctional Active Treatment Hospital.

Characteristics of the groups studied

Table 2 presents the socio-demographic characteristics of the medical professionals' (MP) groups studied.

Table 2. *Characteristics of the socio-demographic data of the medical professionals*

demographic characteristic	**total n=225 (100%)**	**GP n= 87 (38.70%)**	**SD n= 52 (23.10%)**	**NM n=65 (28.90%)**	**OHS n=21 (9.30%)**	**P**
Gender	*n, (%)*	*n, (%)*	*n, (%)*	*n, (%)*	*n, (%)*	*χ^2, df, P*
Men	62 (27.60)	35 (40.20)	23 (44.20)	1 (1.50)	3 (14.30)	χ^2=38.14 df=3 P<0.0001
Women	163 (72.40)	52 (59.80)	29 (55.80)	64 (98.50)	18 (85.70)	
Age						*F, df, P*
Min.	23	30	25	23	24	F=47.74 df=3 P<0.0001
Max.	85	71	85	62	51	
Mean ±SEM	47.21 ±0.83	56.60 ±0.78	43.85 ±1.61	41.26 ±1.40	35.10 ±1.87	
Work experience						*F, df, P*
Min.	1	4	1	1	1	
Max.	58	44	58	41	28	

Mean ±SEM	19.20 ±0.80	26.31 ±0.93	15.87 ±1.56	15.02 ±1.51	10.10 ±1.90	F=24.24 df=3 P<0.0001

The results on the respondents' computer skills and Internet use have been presented in table 3.

Table 3. *Characteristics of the medical professionals' computer skills and frequency of Internet use*

characteristic	**total**	**GP**	**SD**	**NM**	**OHS**	**P**
	n=225	**n= 87**	**n= 52**	**n=65**	**n=21**	
Computer skills	*n, (%)*	*n, (%)*	*n, (%)*	*n, (%)*	*n, (%)*	*χ^2, df, P*
beginner's level	11 (4.90)	3 (3.40)	2 (3.80)	6 (9.20)	0 (0)	χ^2=6.35
intermediate level	74 (32.90)	33 (37.90)	16 (30.80)	20 (30.80)	5 (23.80)	df=6
good level	140 (62.20)	51 (58.60)	34 (65.40)	39 (60.00)	16 (76.20)	P=0.39
Internet use	*n, (%)*	*n, (%)*	*n, (%)*	*n, (%)*	*n, (%)*	*χ^2, df, P*
I do not use it	6 (2.70)	0 (0)	4 (7.70)	2 (3.10)	0 (0)	χ^2=28.80
I rarely use it	35 (15.60)	2 (2.30)	11 (21.20)	17 (26.20)	5 (23.80)	df=6
I use it every day	184 (81.80)	85 (97.70)	37 (71.20)	46 (70.80)	16 (76.20)	**P=0.0001**

Analysis of the attitudes of the study groups regarding EH through statements assessing the potential benefits and concerns

For the needs of the statistical analysis, we conditionally transformed the evaluation of each statement along a five-point Likert rating scale into an interval one by associating the numbers from 1 to 5 with the degrees of agreement, respectively from "1 – fully disagree" to "5 – fully agree". This allowed for a more

complete and precise comparative analysis of the positive and negative statements related to the assessment of attitudes.

Table 4 presents a comparison of the mean scores of positive score and negative score statements.

Table 4. Comparison of the mean scores of all positive and all negative statements

Statements about EH	*Mean*	*±SEM*	*t*	*df*	*P-value*
positive score	3.19	±0.07	-4.74	224	**0.0001**
negative score	3.61	±0.05			

Positive statements about EH evaluating potential benefits

To investigate the attitudes of MP related to the benefits of EH that they expected, 11 positive statements were provided and the respondents indicated their degree of agreement with them. In order to elicit the benefits with the greatest potential contribution, a statistically significant difference between the mean scores of each of the statements was sought, and they were divided into three groups on the basis of the results obtained for a statistically significant difference between them (Table 5). The first group of potential benefits was directed to the health system, and here the statements with the highest mean scores were included; therefore, they could be considered the most expected EH potential benefits for MP. These were **the improved communication and coordination in the health system, more information about public health and avoidance of unnecessary or repeated tests**.

The second group, patient care, included improved patient care through the use of electronic medical records (EMD), more efficient consultations and the development of personalised care.

The third group was aimed at the treatment quality and included the statements rated the lowest through the degree of agreement expressed by the respondents. These included easier compliance with indications, patients' health education, improved treatment quality, reduction of medical errors, and more accurate diagnoses.

Table 5. *Mean scores on the statements related to potential positive consequences of EH implementation arranged in descending order*

	statement	*N*	*Min.*	*Max.*	***Mean***	*SD*
I grp	It will improve the coordination between the different levels of the health system	225	1	5	**3.50**	1.15
	It will improve the communication between healthcare specialists	225	1	5	**3.49**	1.24
	It will provide more information about clinical studies and public health	225	1	5	**3.47**	1.16
	Unnecessary or repeated tests will be avoided	225	1	5	**3.42**	1.29
II grp	The medical professionals' access to electronic medical records will improve patient care	225	1	5	**3.36**	1.28
	It will allow for more efficient consultations	225	1	5	**3.14**	1.31
	It will assist the development of personalised care	225	1	5	**3.10**	1.24
III grp	It will facilitate the compliance with the indications and the patients' health education	225	1	5	**2.99**	1.30
	It will improve the treatment quality	225	1	5	**2.93**	1.30
	It will reduce medical errors	225	1	5	**2.89**	1.25
	It will facilitate more accurate diagnoses	225	1	5	**2.84**	1.29
	Total score	225	1	5	**3.19**	1.03

The comparison of the mean score of the positive statements by specialty showed a highly significant statistically significant difference in the total score of positive statements between GPs and other groups of specialists. The reason for this lies in the significantly lower arithmetic mean values in the results of the GP group (fig. 1).

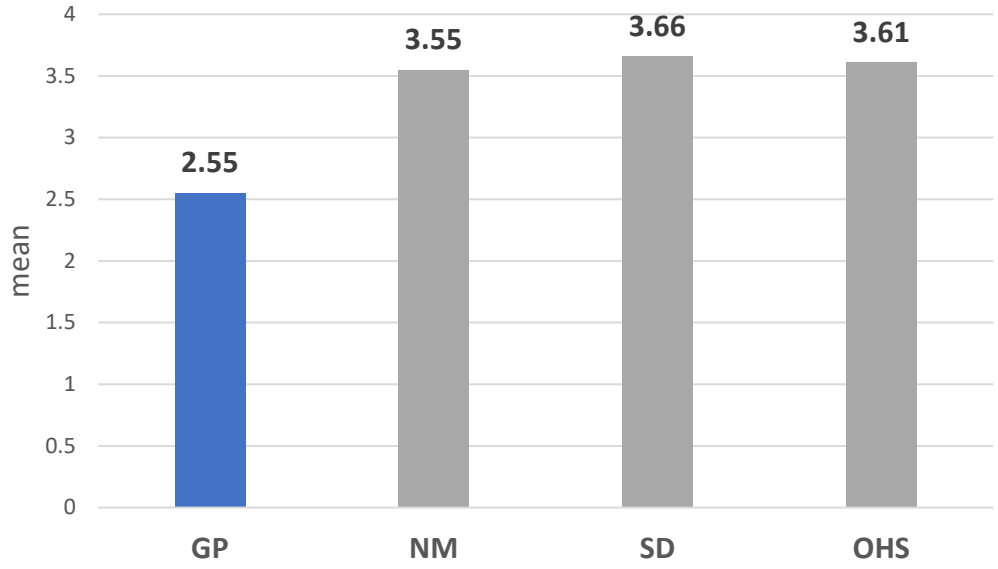

Figure 1. *Comparison of the mean score of positive statements by specialty*

The respondents' demographic characteristics affected their attitudes towards EH. For each of the statements about the potential benefits, the mean score of women was lower than that of men, with a statistically significant difference found in the "better treatment quality", "more accurate diagnoses", "reducing medical errors" and "provision of information on clinical studies and public health" (table 6).

Table 6. *Positive statements with a statistically significant difference by gender*

Positive statements	***Men (n=62)***	***Women (n=163)***	*t*	*P-value*
	mean ±SEM	*mean ±SEM*		
It will improve treatment quality	3.21 ±0.164	2.83 ±0.101	1.9	**0.048**
It will facilitate more accurate diagnoses	3.15 ±0.176	2.72 ±0.097	2.21	**0.028**
It will reduce medical errors	3.24 ±0.164	2.75 ±0.095	2.64	**0.009**
It will provide more information on clinical studies and public health	3.77 ±0.131	3.36 ±0.093	2.44	**0.015**

On the basis of the respondents' average age of 47 years, two age groups were formed: up to 50 years and above 50 years old. A statistically significant difference was found in the attitudes of MP towards the positive statements and their age for each of the statements with the positive expectations regarding EH. The respondents who were in the above-50-year-old group demonstrated

considerably more pessimistic attitudes towards the potential benefits of EH than those who were under 50 years old (table 7).

Table 7. *Comparison of the average score of the positive statements by age group*

Positive statements	***Up to 50 years old***	***Above 50 years old***	*t*	*P-value*
	mean± SEM	*mean± SEM*		
It will improve the treatment quality	3.19± 0.11	2.65± 0.13	3.137	**0.002**
It will facilitate the more accurate diagnoses	3.09± 0.11	2.56± 0.13	3.155	**0.002**
It will reduce medical errors	3.10± 0.10	2.65± 0.13	2.711	**0.007**
It will allow for more efficient consultations	3.51± 0.10	2.74± 0.14	4.604	**0.0001**
Unnecessary or repeated tests will be avoided	3.62± 0.10	3.20± 0.14	2.488	**0.014**
It will improve the communication between healthcare specialists	3.76± 0.10	3.20± 0.13	3.519	**0.001**
It will facilitate the compliance with the indications and the patients' health education	3.32± 0.11	2.62± 0.13	4.222	**0.0001**
It will provide more information about clinical studies and public health	3.66± 0.09	3.27± 0.12	2.489	**0.014**
It will improve the coordination between the different levels of the health system	3.76± 0.09	3.21± 0.12	3.679	**0.0001**
The medical professionals' access to electronic medical records will improve patient care	3.61± 0.11	3.09± 0.13	3.085	**0.002**
It will assist the development of personalised care	3.40± 0.11	2.78± 0.12	3.864	**0.0001**
Total score	3.46± 0.08	2.91± 0.11	4.150	**0.0001**

Negative statements about EH evaluating the concerns related to its implementation

The MPs' concerns about EH were studied through 10 statements that the respondents expressed their degree of agreement about (table 8).

Table 8. *Results of the statements related to the concerns about the implementation of EH arranged by their mean scores*

statement	*N*	*Min.*	*Max.*	***Mean***	*SD*
Risk of system failure	225	1	5	**3.76**	1.15
Lack of time associated with additional workload	225	1	5	**3.71**	1.12
Lack of effective training of health personnel regarding health technologies	225	1	5	**3.64**	1.14
Lack of regulated payment for electronic health services	225	1	5	**3.63**	1.14
Lack of security and control	225	1	5	**3.62**	1.07
Lack of technical support	225	1	5	**3.60**	1.13
Lack of interoperability and regulatory standards	225	1	5	**3.57**	1.02
Lack of appropriate information and communication skills on the part of health personnel	225	1	5	**3.55**	1.13
Probability that electronic healthcare will take precedence over traditional healthcare	225	1	5	**3.55**	1.14
Lack of a regulatory, legislative and ethical framework regarding data confidentiality	225	1	5	**3.49**	1.09
Total score	225	1	5	**3.61**	0.81

The group of statements evaluated with the highest degree of agreement and outlining the greatest concerns among healthcare professionals about the implementation of EH focused the attitudes of healthcare professionals on four main areas: risk of technical problems, excessive time commitment, insufficient training according to modern healthcare technologies and lack of regulated payment for digital health services.

The second group comprised statements evaluated with a significantly lower degree of agreement than those in the previous group. They were focused on the lack of security and control, lack of technical support, lack of interoperability and

regulatory standards, and lack of appropriate information and communication skills on the part of healthcare personnel.

The third group included the statements statistically evaluated with the lowest degree of concern among the rest of the negative statements: fear that EH would take precedence over traditional healthcare and lack of a regulatory, legislative and ethical framework regarding data confidentiality. In fact, these were two separate concerns, semantically united by ethical norms.

The application of the T-test for the gender factor among the respondents did not show any statistically significant difference in the attitudes between men and women regarding EH concerns. The age factor was found to have a considerable effect on the respondents' attitudes for two of the statements with concerns about EH (fig. 2). The respondents above 50 were considerably more concerned about the "*lack of time due to extra workload*" and "*probability that EH will take precedence over traditional healthcare*" than the younger respondents.

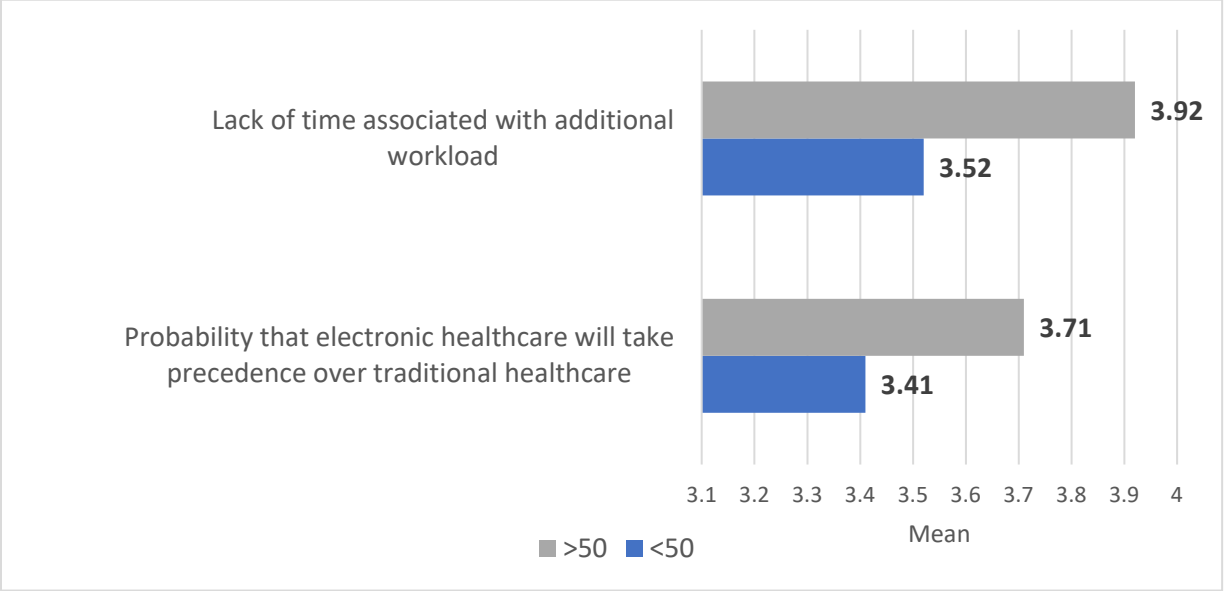

Figure 2. *Negative statements with a statistically significant difference by age group*

The non-parametric analysis applied (χ^2 criterion) on the effect of the specialty on the distribution of the negative statement scores exhibited a statistically significant difference only in the statement related to the risk of system failure, the greatest concerns about this having been expressed in the GP group (table 9).

Table 9. *Effect of the specialty on the distribution of the score given to the statement "Risk of system failure"*

Risk of system failure				
specialty groups	*I disagree number (%)*	*neutral position number (%)*	*I agree number (%)*	*Total number (%)*
GP	12 (13.80)	11 (12.60)	64 (73.60)	87 (100)
NM	12 (18.50)	13 (20.00)	40 (61.50)	65 (100)
SD	6 (12.00)	19 (38.00)	25 (50.00)	50 (100)
OHS	4 (19.00)	4 (19.00)	13 (62.00)	21 (100)
Total	34 (15.20)	47 (21.10)	142 (63.70)	223 (100)
	χ^2=13.78, df=6, **P=0.032**			

The results of the comparison of the mean scores of the positive and negative statements about EH showed that the negative scores had a statistically significantly higher score than the positive ones (table 4). Moreover, the highest mean score of the positive statements was similar to the lowest of the negative ones. The analysis of the results also highlighted the pessimistic attitudes of GP.

Use of digital health services and mobile health applications in the practice of the medical professionals groups studied

The digital health services that the respondents had had access to so far were searched by offering seven functionality selection options. The relative frequency of the digital health services accessed by the respondents has been presented in fig. 3 in descending order.

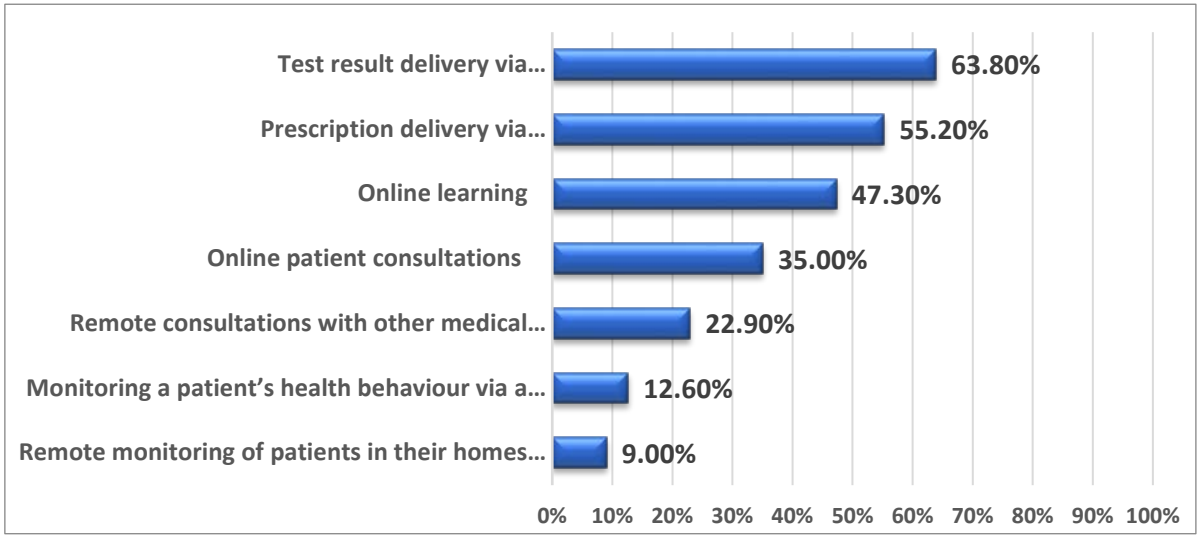

Figure 3. *Relative frequency of the answers to the question "Which of the following telemedicine services can you access at the moment?" arranged in descending order.*

The delivery of test results and prescriptions via Viber, Messenger, Skype, or email were the two most commonly used telemedicine functions that the largest proportion of respondents had access to. Online learning was another telemedicine functionality that was actively used during the pandemic, and almost half of the respondents had access to digital learning. About one-third of the respondents had conducted online consultations with patients, and monitoring a patient's health behaviour via a mobile application and remote monitoring of patients in their homes were the functionalities with the least usability among the medical professionals surveyed.

The results of the analysis with the $\chi 2$ criterion on the various telemedicine services that the respondents had access to and their comparison by specialty have been presented in table 10.

Table 10. *Distribution by respondents' specialties and the telemedicine services used by them*

Online patient consultations				
	yes n (%)	*no n (%)*	*I cannot answer n (%)*	*total n (%)*
total	**78 (35.00)**	**118 (52.90)**	**27 (12.10)**	**223 (100.00)**
GP	39 (44.90)	43 (49.40)	5 (5.70)	87 (100.00)
NM	19 (29.70)	34 (53.10)	11 (17.20)	64 (100.00)
SD	19 (37.30)	24 (47.10)	8 (15.70)	51 (100.00)
OHS	1 (4.80)	17 (81.00)	3 (14.30)	21 (100.00)
P-value	χ^2=17.03 df=6 **P=0.009**			
Prescription delivery via Viber/Messenger/Skype/email n (%)				
	yes n (%)	*no n (%)*	*I cannot answer n (%)*	*total n (%)*
total	**123 (55.20)**	**78 (35.00)**	**22 (9.90)**	**223 (100.00)**
GP	54 (62.10)	28 (32.20)	5 (5.70)	87 (100.00)
NM	34 (53.10)	24 (37.50)	6 (9.40)	64 (100.00)
SD	24 (47.10)	19 (37.30)	8 (15.70)	51 (100.00)
OHS	11 (52.40)	7 (33.30)	3 (14.30)	21 (100.00)
P-value	χ^2=5.52.03 df=6 P=0.479			

Test result delivery via Viber/Messenger/Skype/email n (%)				
	yes n (%)	*no n (%)*	*I cannot answer n (%)*	*total n (%)*
total	**143 (63.80)**	**64 (28.60)**	**17 (7.60)**	**224 (100.00)**
GP	63 (72.40)	20 (23.00)	4 (4.60)	87 (100.00)
NM	41 (63.10)	17 (26.20)	7 (10.80)	65 (100.00)
SD	26 (51.00)	21 (41.20)	4 (7.80)	51 (100.00)
OHS	13 (61.90)	6 (28.60)	2 (9.50)	21 (100.00)
P-value	χ^2=8.26 df=6 P=0.220			
Monitoring a patient's health behaviour via a mobile health application n (%)				
	yes n (%)	*no n (%)*	*I cannot answer n (%)*	*total n (%)*
total	**28 (12.60)**	**158 (70.90)**	**37 (16.50)**	**223 (100.00)**
GP	9 (10.30)	73 (83.90)	5 (5.70)	87 (100.00)
NM	9 (14.10)	38 (59.40)	17 (26.60)	64 (100.00)
SD	8 (15.70)	32 (62.70)	11 (21.60)	51 (100.00)
OHS	2 (9.50)	15 (71.40)	4 (19.00)	21 (100.00)
P-value	χ^2=15.60 df=6 **P=0.016**			
Remote consultations with other medical professionals n (%)				
	yes n (%)	*no n (%)*	*I cannot answer n (%)*	*total n (%)*
total	**51 (22.90)**	**136 (61.00)**	**36 (16.10)**	**223 (100.00)**
GP	11 (12.60)	70 (80.50)	6 (6.90)	87 (100.00)
NM	18 (28.10)	34 (53.10)	12 (18.80)	64 (100.00)
SD	17 (33.30)	20 (39.20)	14 (27.50)	51 (100.00)
OHS	5 (23.80)	12 (57.10)	4 (19.00)	21 (100.00)
P-value	χ^2=26.30 df=6 **P=0.0001**			
Remote monitoring of patients in their homes (telemonitoring) n (%)				
	yes n (%)	*no n (%)*	*I cannot answer n (%)*	*total n (%)*
total	**20 (9.00)**	**150 (67.90)**	**51 (23.10)**	**221 (100.00)**
GP	9 (10.30)	70 (80.50)	8 (9.20)	87 (100.00)
NM	7 (10.90)	37 (57.80)	20 (31.30)	64 (100.00)
SD	3 (6.10)	28 (57.10)	18 (36.70)	49 (100.00)
OHS	1 (4.80)	15 (71.40)	5 (23.80)	21 (100.00)
P-value	χ^2=18.24 df=6 **P=0.006**			

Online learning n (%)				
	yes n (%)	*no n (%)*	*I cannot answer n (%)*	*total n (%)*
total	**105 (47.30)**	**81 (36.50)**	**36 (16.20)**	**222 (100.00)**
GP	35 (40.20)	43 (49.40)	9 (10.30)	87 (100.00)
NM	37 (57.90)	18 (28.10)	9 (14.10)	64 (100.00)
SD	20 (40.00)	16 (32.00)	14 (28.00)	50 (100.00)
OHS	13 (61.90)	4 (19.00)	4 (19.00)	21 (100.00)
P-value	χ^2=17.59 df=6 **P=0.007**			

A statistically significant influence of the respondents' specialty was found for five out of the seven remote health services offered. GP accounted for the largest share of specialists who consulted their patients online, but they had the smallest share in monitoring a patient's health behaviour through MHA. SD conducted the largest number of remote consultations with other professionals. OHS and NM were among the specialists who had the largest share of participation in the online training service.

Analysis of the respondents' attitudes towards the use of MHA in patient practice

The attitudes of medical professionals towards the recommendations for MHA use by their patients have been presented in fig. 4.

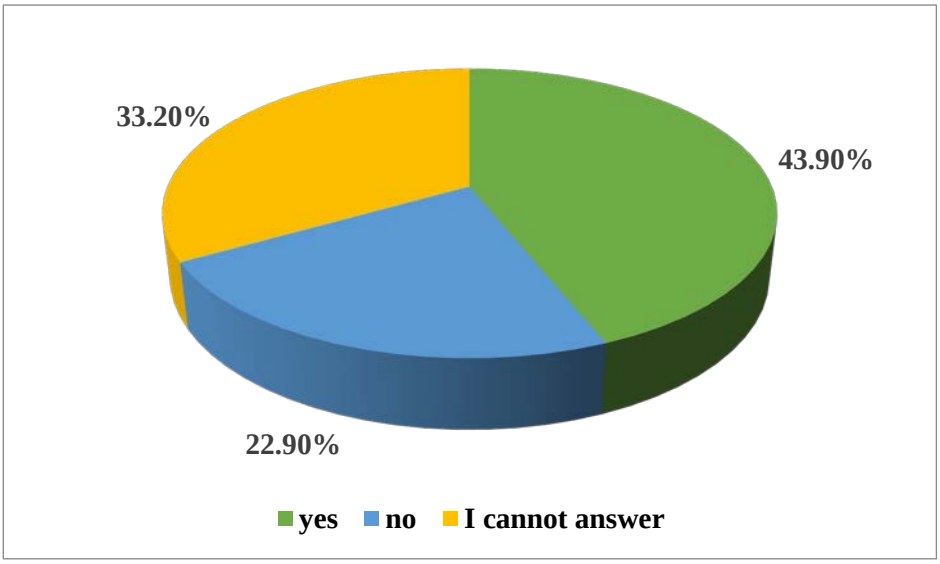

Figure 4. *Relative share of the answers to the question "Would you recommend that your patients use a mobile health application?"*

The results of the analysis made of the respondents' attitude to the use of MHA by their patients distributed according to the specialties of the four groups studied have been presented in table 11.

***Table 11**. Distribution of the answers to the question "Would you recommend that your patients use a mobile health application?" by specialty*

Would you recommend that your patients use a mobile health application?				
	yes n (%)	*no n (%)*	*I cannot answer n (%)*	*Total n (%)*
total	**98 (43.90)**	**51 (22.90)**	**74 (33.20)**	**223 (100.00)**
GP	24 (27.60)	34 (39.10)	29 (33.30)	87 (100.00)
NM	37 (56.90)	8 (12.30)	20 (30.80)	65 (100.00)
SD	25 (50.00)	6 (12.00)	19 (38.00)	50 (100.00)
OHS	12 (57.10)	3 (14.30)	6 (28.60)	21 (100.00)
P-value	χ^2=26.07 df=6 **P=0.0001**			

A significant difference was found in the respondents' attitude towards the use of MHA by their patients, with GP least likely to recommend such applications.

In order to track and analyse the use of MHA by the respondents, three groups of patients were outlined according to the type of disease and the purpose of using MHA, as well as an option for those who did not use MHA in their practice:

- Patients with acute diseases;
- Patients with chronic diseases;
- Patients with a degree of disability;
- A "Not using" option.

The relative frequency of the use of MHA by the respondents according to the types of diseases has been presented in fig. 5.

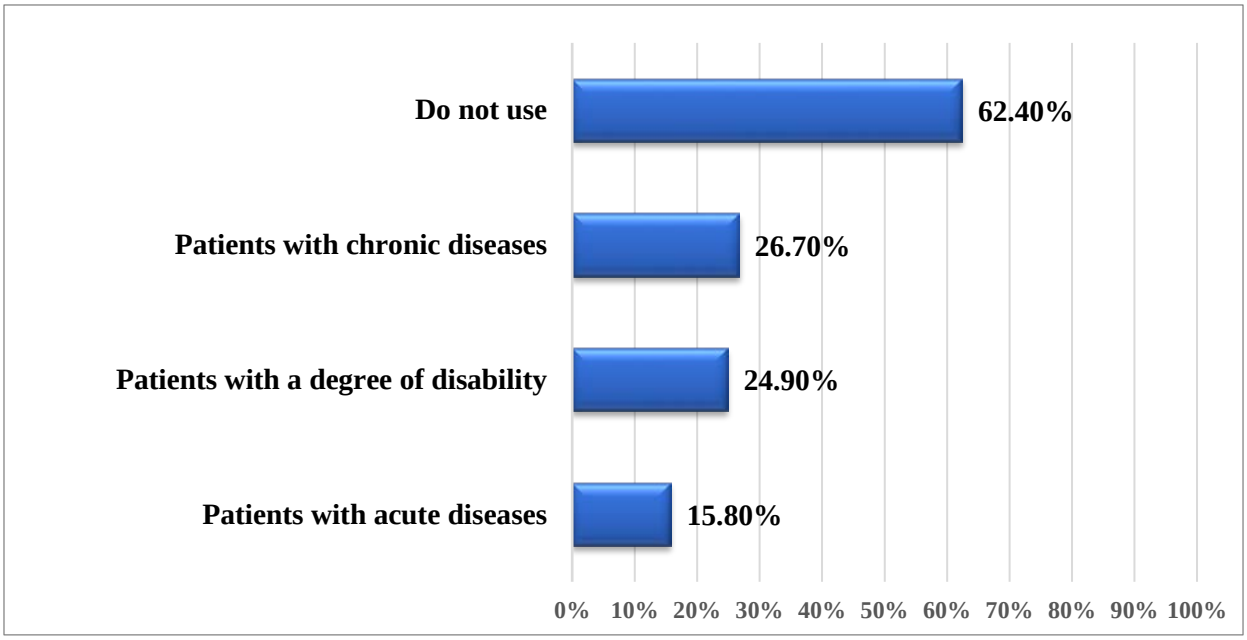

Figure 5. *Relative frequency of the answers to the question "If you use mobile health applications to monitor your patients' status in your practice, you do it for patients with:" arranged in descending order*

The comparison of the use of MHA according to the patients' diseases and the respondents' specialty did not show statistically significant differences.

Impact of information technology on doctor-patient relationships

For the purposes of this task, five potential situations related to patient searches for health information on the Internet were proposed, the frequency of which respondents had to rate with one of the following categories: often, sometimes, rarely, never. The frequency distribution of responses to the question "How often do you encounter each one of the following situations related to health information that your patients find online?" have been presented in Fig. 6.

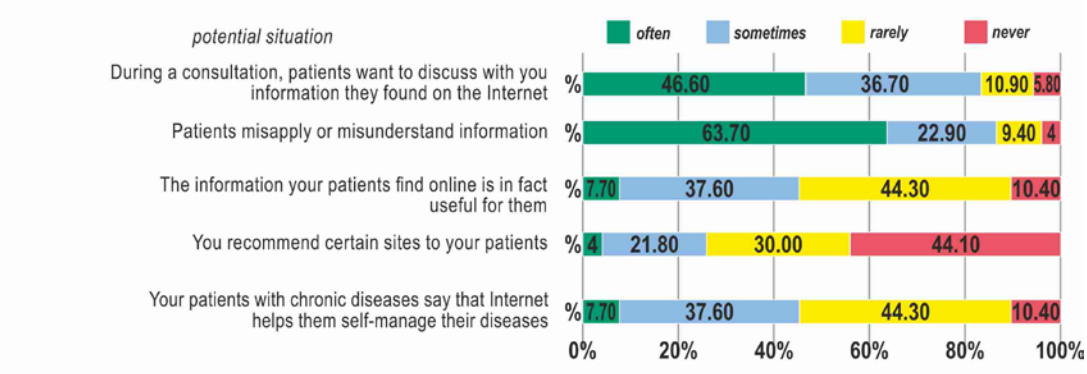

Figure 6. *Frequency of the situations connected with the use of online health information by patients*

The analysis of the respondents' answers and specialty established a statistically significant difference in three of the five potential situations (table 12).

Table 12. *Evaluation of the frequency of the potential situations studied by specialty*

During a consultation, patients want to discuss with you information they found on the Internet					
	often n (%)	*sometimes n (%)*	*rarely n (%)*	*never n (%)*	*total n (%)*
total	**103 (46.60)**	**81 (36.70)**	**24 (10.90)**	**1 (5.80)**	**221 (100.00)**
GP	47 (54.00)	33 (37.90)	6 (6.90)	1 (1.10)	87 (100.00)
NM	31 (48.40)	21 (32.80))	8 (12.50)	4 (6.30)	64 (100.00)
SD	13 (12.60)	23 (46.90)	6 (12.20)	7 (14.30)	49 (100.00)
OHS	12 (57.10)	4 (19.00)	4 (19.00)	1 (4.80)	21 (100.00)
P-value	χ^2=21.35 df=9 **P=0.011**				
Patients misapply or misunderstand information					
	often n (%)	*sometimes n (%)*	*rarely n (%)*	*never n (%)*	*total n (%)*
total	**142 (63.70**	**51 (22.90)**	**21 (9.40)**	**9 (4.00)**	**223 (100.00)**
GP	71 (81.60)	13 (14.90)	2 (2.30)	1 (1.10)	87 (100.00)
NM	38 (58.50)	18 (27.70)	8 (12.30)	1 (1.510)	65 (100.00)
SD	18 (36.00)	17 (34.00)	10 (20.00)	5 (10.00)	50 (100.00)
OHS	15 (71.40)	3 (14.30)	1 (4.80)	2 (9.50)	21 (100.00)
P-value	χ^2=37.78 df=9 **P=0.0001**				
The information your patients find online is in fact useful for them					
	often n (%)	*sometimes n (%)*	*rarely n (%)*	*never n (%)*	*total n (%)*
total	**17 (7.70)**	**83 (37.60)**	**98 (44.30)**	**23 (10.40)**	**221 (100.00)**
GP	3 (3.40)	30 (34.50)	45 (51.70)	9 (10.30)	87 (100.00)
NM	10 (15.60)	26 (40.60)	24 (37.50)	4 (6.30)	64(100.00)
SD	3 (6.10)	15 (30.60)	25 (51.00)	6 (12.20)	49 (100.00)
OHS	1 (4.80)	12 (57.10)	4 (19.00)	4 (19.00)	21 (100.00)
P-value	χ^2=18.81 df=9 **P=0.027**				
You recommend certain sites to your patients					
	often	*sometimes*	*rarely*	*never*	*total*

	n (%)	*n (%)*	*n (%)*	*n (%)*	*n (%)*
total	**9 (4.10)**	**48 (21.80)**	**66 (30.00)**	**97 (44.10)**	**220 (100.00)**
GP	1 (1.10)	19 (21.80)	26 (29.90)	41 (47.10)	87 (100.00)
NM	4 (6.30)	7 (10.90)	22 (34.40)	31 (48.40)	64(100.00)
SD	2 (4.20)	15 (31.30)	12 (25.00)	19 (39.60)	48 (100.00)
OHS	2 (9.50)	7 (33.30)	6 (28.60)	6 (28.60)	21 (100.00)
P-value	χ^2=13.44 df=9 P=0.144				
Your patients with chronic diseases say that Internet helps them self-manage their diseases					
	often n (%)	*sometimes n (%)*	*rarely n (%)*	*never n (%)*	*total n (%)*
total	**18 (8.10)**	**66 (29.90)**	**74 (33.50)**	**63 (28.50)**	**221 (100.00)**
GP	6 (6.90)	22 (25.30)	33 (37.90)	26 (29.90)	87 (100.00)
NM	7 (10.90)	24 (37.50)	16 (25.00)	17 (26.60)	64(100.00)
SD	3 (6.10)	14 (28.50)	16 (32.70)	16 (32.70)	49 (100.00)
OHS	2 (9.50)	6 (28.60)	9 (42.90)	4 (19.00)	21 (100.00)
P-value	χ^2=6.52 df=9 P=0.687				

Among the groups of medical professionals studied, statistically significant differences were found in the patients' behaviour. The GPs' patients who wanted to discuss the information found online showed the highest frequency compared to the patients of the other specialist groups. Likewise, again, GPs' patients were those most likely to misapply or misunderstand the information they found on the internet. At the same time, according to GP, it is rare for their patients to find information that is useful to them.

The results of the present study showed that Bulgarian medical professionals had a conservative approach to the process of patient empowerment.

2. Study of public attitudes to COVID-19 and the use of digital health technologies related to it

For the purposes of the study, the respondents were divided into two groups in the presentation of the results according to the period of the surveys conducted, respectively:

- Stage 1 (S1) included respondents from the survey conducted in the 04.2020 – 07.2020 period
- Stage 2 (S2) included respondents from the survey conducted in the 04.2021 – 07.2021 period.

Characteristics of the groups studied

Two surveys conducted online via Google Forms were used. The responses of 309 (n=309) respondents were collected, among whom 162 (n=162) completed surveys in S1, and 147 (n=147) in S2. Table 13 presents the demographic characteristics of the surveyed respondents, and table 14 their characteristics related to computer skills and Internet use.

Table 13*. Demographic characteristics of the groups studied*

Characteristics	***total*** ***n=309 (100%)***	***E1*** ***n=162 (52.43%)***	***E2*** ***n=147 (47.57%)***	***P-value***
Gender	*n (%)*	*n (%)*	*n (%)*	*χ^2, df, P*
Men	76 (24.60)	45 (27.80)	31 (21.10)	χ^2=1.86 df=1 P=0.173
Women	233 (75.40)	117 (72.20)	116 (78.90)	
Age				*t, P*
Min.	18	18	18	t=5.70, P=**0.0001**
Max.	74	74	63	
Mean±SEM	35.8±083	40.10±1.15	31.05±1.08	
Age groups				*t, P*
up to 35 years of age	158 (51.10)	62 (38.30)	96 (65.30)	t=4.92, **P=0.0001**
above 35 years of age	151 (48.90)	100 (61.70)	51 (34.70)	
Education	*n (%)*	*n (%)*	*n (%)*	*χ^2, df, P*
Primary	9 (2.90)	9 (5.60)	0 (0)	χ^2=46.49 df=2 **P=0.0001**
Secondary	122 (39.50)	36 (22.20)	86 (58.50)	
Higher	178 (57.60)	117 (72.20)	61 (41.50)	

Table 14. *Characteristics of the groups studied related to their computer skills and Internet use*

Characteristics	***total*** ***n=309 (100%)***	***E1*** ***n=162 (52.43%)***	***E2*** ***n=147 (47.57%)***	***P-value***
Computer literacy	*n (%)*	*n (%)*	*n (%)*	*χ^2, df, P*
beginner's level of computer skills	22 (7.10)	4 (2.50)	18 (12.20)	χ^2=33.26 df=2 **P=0.0001**
intermediate level of computer skills	151 (48.90)	103 (63.50)	48 (32.70)	
good level of computer skills	136 (44.00)	55 (34.00)	81 (55.10)	

Internet use at the workplace	*n (%)*	*n (%)*	*n (%)*	*χ², df, P*
I do not use the Internet	6 (1.90)	2 (1.20)	4 (2.70)	χ^2=5.71 df=2 P=0.058
I rarely use the Internet	13 (4.20)	3 (1.90)	10 (6.80)	
I use the Internet every day	290 (93.90)	157 (96.90)	133 (90.50)	

Public attitudes toward the use of telemedicine consultations and awareness of COVID-19 in Stage 1 of the study

In order to track the users' attitudes towards the use of DHT during the pandemic, we first examined the entry of digital technologies into their lives and occupations and the changes associated with them. Fig. 7 shows the results of the impact of the emergency situation on the respondents' professional lives.

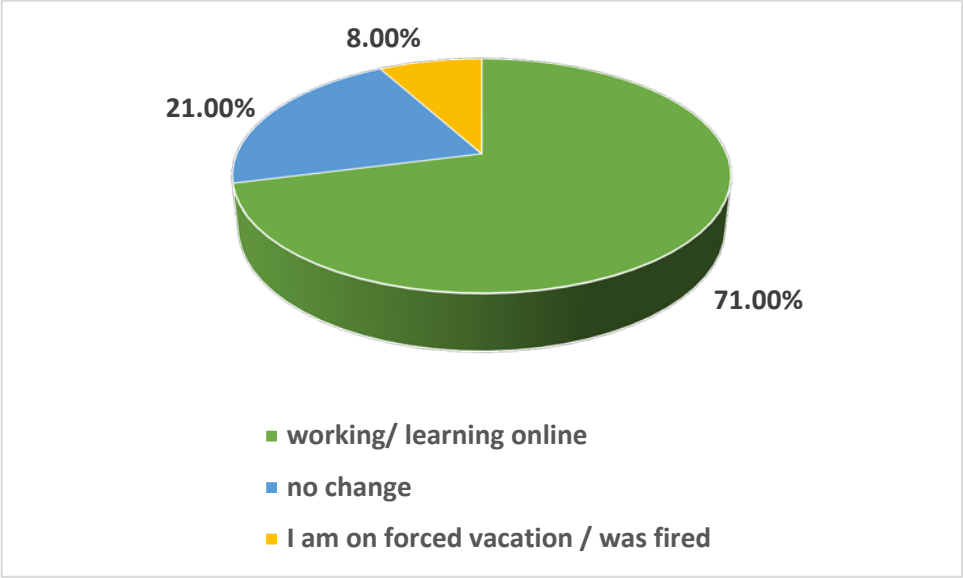

Figure 7. *Distribution of the answers to the question "How did the COVID-19-related emergency situation affect your work?"*

In relation to the previous question, we investigated the respondents' attitude towards the entry of digital technologies into their daily lives. For this purpose, they had to rate a statement related to the rapid penetration of digital technologies and how worried they felt on a four-point Likert scale ranging from "fully disagree" to "fully agree". The results have been presented in Fig. 8.

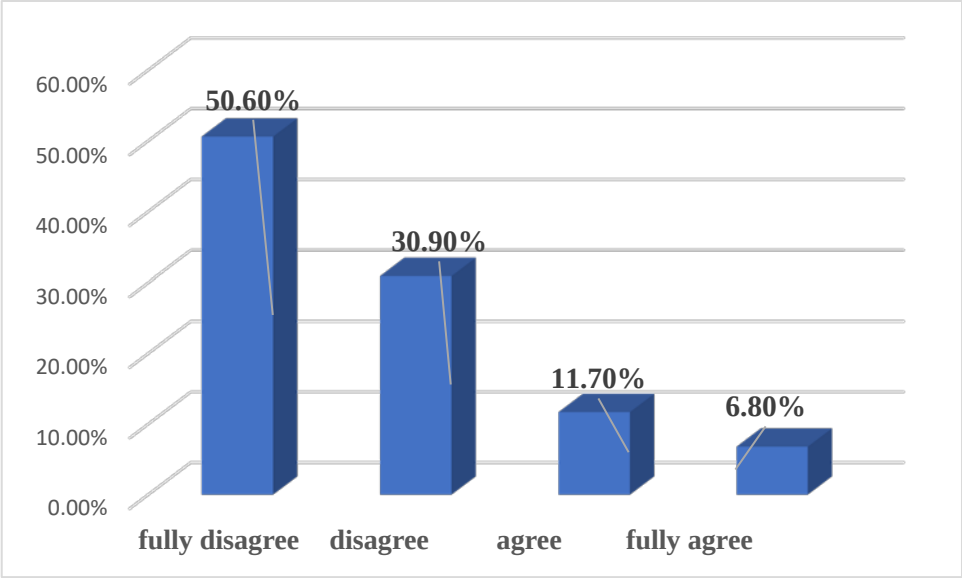

Figure 8. *Distribution of the answers to the question "The penetration of digital technologies into my life and work worries me and I find it hard to cope"*

An analysis was applied to establish the relationship between the respondents' "education" and "level of computer skills" characteristics and the way in which the increased use of digital technologies affected their daily lives. The results of the analysis have been shown in table 15.

Table 15. *Comparison of the degree of agreement with the statement "The penetration of digital technologies into my life and work worries me and I find it hard to cope" distributed by education and computer skills*

The penetration of digital technologies into my life and work worries me and I find it hard to cope	***fully disagree n (%)***	***disagree n (%)***	***agree n (%)***	***fully agree n (%)***	***total***
total	**82 (50.60)**	**50 (30.90)**	**19 (11.70)**	**11 (6.80)**	**162 (100.00)**
education					
primary	9 (100.00)	0 (0)	0 (0)	0 (0)	9 (100.00)
secondary	14 (38.90)	12 (33.30)	5 (13.90)	5 (13.90)	36 (100.00)

higher	59 (50.40)	38 (32.50)	14 (12.00)	6 (5.10)	117 (100.00)
P-value	χ^2=13.23 df=6 **P=0.040**				
computer literacy level					
beginner's	1 (25.00)	1 (25.00)	2 (50.00)	0 (0)	4 (100.00)
intermediate	42 (40.80)	35 (34.00)	17 (16.50)	9 (8.70)	103 (100.00)
good	39 (70.90)	14 (25.50)	0 (0)	2 (3.60)	55 (100.00)
P-value	χ^2=23.96 df=6 **P=0.001**				

Statistically significant differences in the respondents' attitudes were found depending on their education and computer skills. The ones having a good computer literacy level were the least worried about the penetration of digital technologies. No statistically significant difference was found in the attitude towards the penetration of digital technologies into the respondents' daily lives by gender and age groups.

The following question aimed to explore the respondents' attitudes towards the use of an online platform for consultations related to COVID-19. The results have been presented in fig. 9.

Figure 9*. Distribution of the answers to the question "Would you use a 24/7 online platform for consultations related to COVID-19?"*

The analysis applied to the relationship between the attitude towards the use of an online platform and the respondents' characteristics showed a significant

dependence only for education. The result of the analysis has been presented in table 16.

Table 16. *Comparison of the answers to the question "Would you use a 24/7 online platform for consultations related to COVID-19?" by education*

Would you use a 24/7 online platform for consultations related to COVID-19?	***yes n (%)***	***no n (%)***	***I cannot decide n (%)***	***χ^2, df, P***
total	**90 (55.60)**	**40 (24.70)**	**32 (19.80)**	**162 (100.00)**
education				
primary	4 (44.40)	1 (11.10)	4 (44.40)	9 (100.00)
secondary	19 (52.80)	14 (38.90)	3 (8.30)	36 (100.00)
higher	67 (57.30)	25 (21.40)	25 (21.30)	117 (100.00)
P-value	χ^2=9.76 df=4 **P=0.045**			

The level of education had a statistically significant influence on the respondents' attitudes: those with primary education had the largest share of the ones who could not decide. No significant difference was found in the respondents' preferences on the basis of gender and age; the computer literacy level did not affect the respondents' attitudes towards such a platform, either.

In order to explore the respondents' preferred sources of information during a pandemic, three options were proposed: television and radio, online information sites and print media, and the question allowed for multiple choices. Its results have been shown in fig. 10.

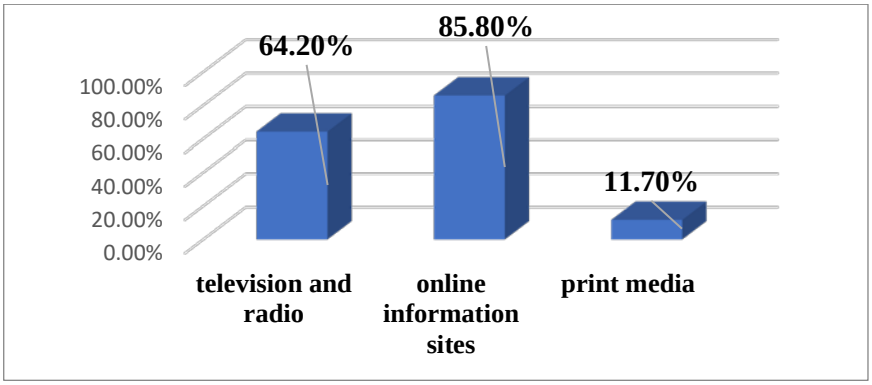

Figure 10. *Relative frequency of the answers to the question "Where do you get information related to COVID-19?"*

The analysis applied to the respondents' information source preferences and characteristics showed no statistically significant difference in any of the factors analysed.

Public attitudes towards the use of telemedicine consultations and awareness of COVID-19 in Stage 2 of the study

In S2 of the present study, the question about the preferred ways of seeking information in S1 was modified, shifting its focus to ways of disseminating information about existing applications related to COVID-19 that would most likely reach the respondents. Fig. 11 presents the results of the answers, the question being of the multiple choice type.

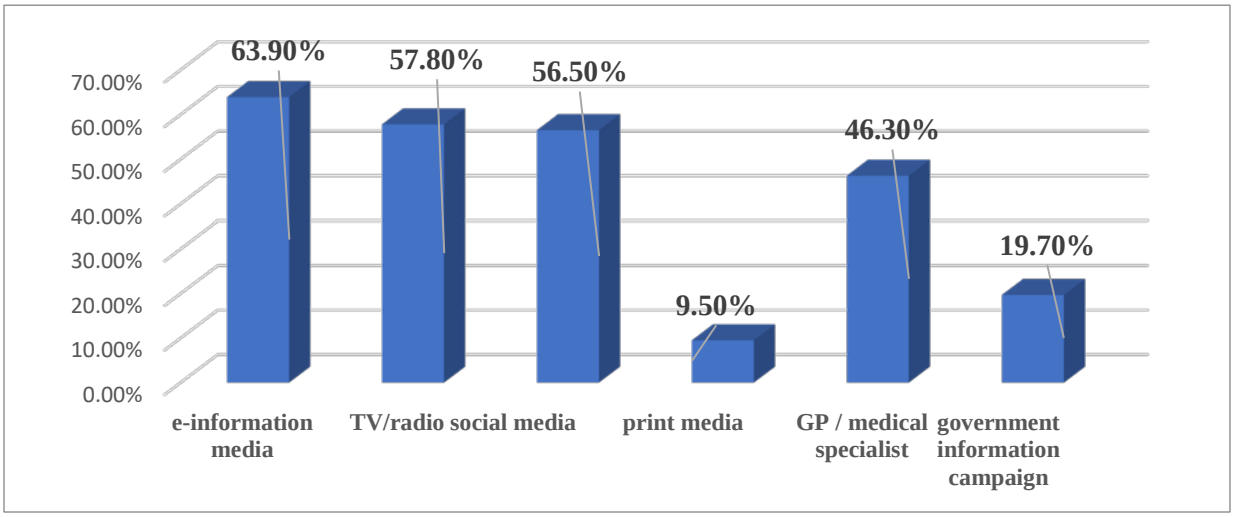

Figure 11. *Relative frequency of the answers to the question "What is the most certain way for information about existing COVID-19-related applications to reach you?"*

A statistically significant difference associated with gender was found in the preferences for electronic information media and television and radio as a source of information, with significant preponderance of women, and through a government information campaign, with preponderance of men. Among the age groups, there was a statistical difference in the preferences of up-to-30-year-old respondents towards social media. Education was a statistically significant factor in choosing a government information campaign as a reliable source, and for respondents with higher education it was a significantly more preferred source than for those with secondary education (table 17).

Table 17. *Comparison of the answers to the question "What is the most certain way for information about existing COVID-19-related applications to reach you?" by gender, age group and education*

Factor: gender			
Electronic information media			
	yes n (%)	*no n (%)*	*total n (%)*
total	**94 (63.90)**	**53 (36.10)**	**147 (100.00)**
men	15 (48.40))	16 (51.60)	31 (100.00)
women	79 (68.10)	37 (31.90)	116 (100.00)
P-value	χ^2=4.13 df=1 **P=0.042**		
Television and radio			
	yes n (%)	*no n (%)*	*total n (%)*
total	**85 (57.80)**	**62 (42.20)**	**147 (100.00)**
men	12 (38.70)	19 (61.30)	31 (100.00)
women	73 (62.90)	43 (37.10)	116 (100.00)
P-value	χ^2=5.89 df=1 **P=0.015**		
Government information campaign			
	yes n (%)	*no n (%)*	*total n (%)*
total	**29 (19.70)**	**118 (80.30)**	**147 (100)**
men	12 (38.70)	19 (61.30)	31 (100)
women	17 (14.70)	99 (85.30)	116 (100)
P-value	χ^2=8.94 df=1 **P=0.003**		

Factor: age groups			
Social media			
	yes n (%)	*no n (%)*	*total n (%)*
total	**83 (56.50)**	**64 (43.50)**	**147 (100.00)**
up to 30 years of age	56 (66.70)	28 (33.30)	84 (100.00)
above 30 years of age	27 (42.90)	36 (57.10)	63 (100.00)
P-value	χ^2=8.30 df=1 **P=0.004**		

Factor: education			
Government information campaign			
	yes n (%)	*no n (%)*	*total n (%)*
total	**29 (19.70)**	**118 (80.30)**	**147 (100.00)**
secondary	10 (11.60)	76 (88.40)	86 (100.00)
higher	19 (31.10)	42 (68.90)	61 (100.00)
P-value	χ^2=8.57 df=1 **P=0.003**		

In the study, the question about the users' attitudes towards the use of MHA in the COVID-19 situation was added to S2. Its results have been presented in fig. 12.

Figure 12. *Distribution of the answers to the question "Would you use mobile health applications in the COVID-19 situation?"*

The analysis of the distribution of the answers and the respondents' characteristics demonstrated that education and the level of computer skills had a significant effect on the respondents' attitudes towards using MHA during a pandemic. The better-educated users and those with good computer skills were statistically significantly more likely to use MHA (table 18).

Table 18. *Effect of the respondents' education and computer literacy level on their attitudes towards the use of mobile health applications in the COVID-19 situation*

Would you use mobile health applications in the COVID-19 situation?	***yes***	***no***	***I cannot decide***	***total***
	n (%)	***n (%)***	***n (%)***	***n (%)***
total	**95 (64.60)**	**26 (17.70)**	**26 (17.70)**	**147 (100.00)**
education				
secondary	47 (54.70)	21 (24.40)	18 (20.90)	86 (100.00)
higher	48 (78.70)	5 (8.20)	8 (13.10)	61 (100.00)
P-value	χ^2=9.73 df=2 **P=0.008**			
computer skills				
beginner's	6 (33.30)	10 (55.60)	2 (11.10)	18 (100.00)
intermediate	26 (54.20)	6 (12.50)	16 (33.30)	48 (100.00)
good	63 (77.80)	10 (12.30)	8 (9.90)	81 (100.00)
P-value	χ^2=32.22 df=4 **P=0.0001**			

For the other characteristics, gender and age groups, no statistical significance was found.

The respondents' attitudes regarding the use of online health services offered by medical institutions were investigated. The distribution of the answers to the question has been presented in fig. 13.

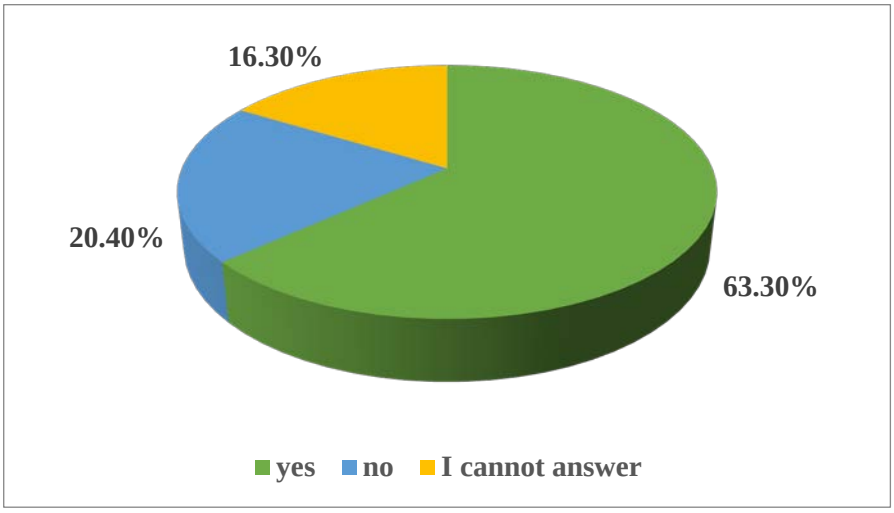

Figure 13. *Distribution of the answers to the question "If medical institutions offered online access to health services, would you use them?"*

The analysis applied demonstrated a statistically significant relationship between the attitudes towards the use of online health services and the age groups, the education acquired and the computer literacy level. Users above 30 years of age, with higher education and good computer skills, showed a significantly greater interest in such services (table 19).

Table 19*. Effect of the respondents' age, education and computer literacy level on their attitudes towards the use of online health services offered in medical institutions*

If medical institutions offered online access to health services, would you use them?	***yes n (%)***	***no n (%)***	***I cannot decide n (%)***	***total n (%)***
total	**93 (63.30)**	**30 (20.40)**	**24 (16.30)**	**147 (100.00)**
age groups				
up to 30 years of age	45 (53.60)	21 (25.00)	18 (21.40)	84 (100.00)
above 30 years of age	48 (76.20)	9 (14.30)	6 (9.50)	63 (100.00)

P-value	χ^2=8.06 df=2 **P=0.018**			
education				
secondary	43 (50.00)	23 (26.70)	20 (23.30)	86 (100.00)
higher	50 (82.00)	7 (11.50)	4 (6.60)	61 (100.00)
P-value	χ^2=15.94 df=2 **P=0.0001**			
computer skills				
beginner's	2 (11.10)	9 (50.00)	7 (38.90)	18 (100.00)
intermediate	33 (68.80)	6 (12.50)	9 (18.80)	48 (100.00)
good	58 (71.60)	15 (18.50)	8 (9.90)	81 (100.00)
P-value	χ^2=26.04 df=4 **P=0.0001**			

2.4. Comparison of the public attitudes towards the use of DHT and services tracked in the course of the pandemic

Four indicators were defined with a view to studying and tracking society's attitudes towards and readiness for the use of DHT and telemedicine services during the pandemic. They covered public attitudes to the use of DHT by the health system under critical conditions, attitudes towards different types of applications and an online platform related to COVID-19, and preferences regarding access to medical consultations. The parameters were examined at both stages of the study.

Indicator 1 – use of digital health technologies in emergency situations

The first indicator examined the public's attitude towards the use of DHT by the health system in critical conditions, such as the pandemic. The respondents' answers have been shown in fig. 14.

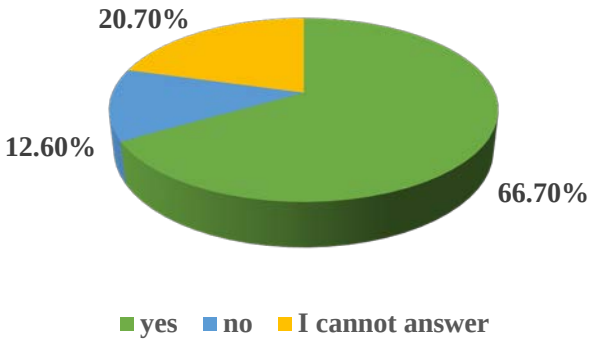

Figure 14. *Distribution of the answers to the question "Do you think that in emergency situations like the current one (the COVID-19 pandemic), the health system should actively turn to digital health technologies?"*

Table 20 shows the distribution of the answers to the question "Do you think that in emergency situations like the current one (the COVID-19 pandemic), the health system should actively turn to digital health technologies?" after applying the χ^2 criterion for comparison between the two stages, gender, age groups, education and computer literacy level.

Table 20. *Distribution of the answers to the question "Do you think that in emergency situations like the current one (the COVID-19 pandemic), the health system should actively turn to digital health technologies?" compared by age group and education*

Do you think that in emergency situations like the current one (the COVID-19 pandemic), the health system should actively turn to digital health technologies?	***yes n (%)***	***no n (%)***	***I cannot decide n (%)***	***χ^2, df, P***
total	**206 (66.70)**	**39 (12.60)**	**64 (20.70)**	**-**
research stage				
S1	108 (66.70)	16 (9.90)	38 (23.50)	χ^2=3.27 df=2 P=0.195
S2	98 (66.70)	23 (15.60)	26 (17.70)	
gender				
men	52 (68.40)	8 (10.50)	16 (21.10)	χ^2=0.40 df=2 P=0.818
women	154 (66.10)	31 (13.30)	48 (20.60)	
age groups				
up to 35 years of age	89 (56.30)	28 (17.70)	41 (25.90)	χ^2=16.13 df=2 **P=0.0001**
above 35 years of age	117 (77.50)	11 (7.30)	23 (15.20)	
education				
primary	4 (1.90)	1 (2.60)	4 (6.30)	χ^2=11.36 df=4 **P=0.023**
secondary	73 (35.40)	23 (59.00)	26 (40.60)	
higher	123 (62.60)	15 (38.50)	34 (53.10)	
computer literacy level				
beginner’s	11 (5.30)	5 (12.80)	6 (9.40)	χ^2=6.47 df=4 P=0.166
intermediate	96 (46.60)	19 (48.70)	36 (56.30)	
good	99 (48.10)	15 (38.50)	22 (34.40)	

The results indicated that between the two study periods, the public attitudes towards the use of DHT in emergency situations did not change and remained the same. No statistically significant difference was found in the answers to the question between men and women. Regarding the users' age and attitude towards the use of DHT during a pandemic, a statistically significant difference was found in the two age groups: those in the age group above 35 significantly considered the use of DHT necessary in emergency situations. A statistically significant difference was found in the respondents' attitudes and their education, those with higher education being the most likely to use DHT in emergency situations.

Indicator 2 - Consumer use of applications related to COVID-19

For the next indicator, attitudes towards the use of applications related to COVID-19, the respondents were offered three variants of applications, the question having a multiple choice option, including the "I would not use" category. The results have been presented in fig. 15.

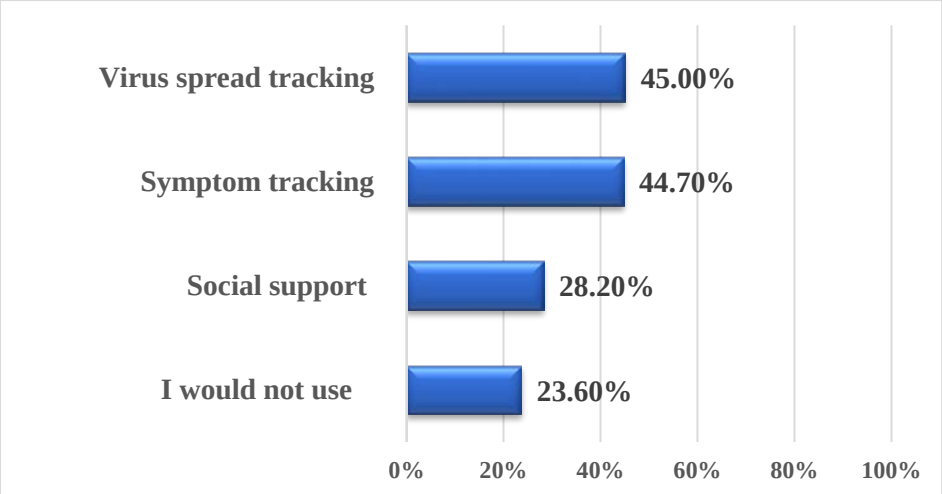

Figure 15. *Distribution of the answers to the question "Which one of the following applications related to COVID-19 would you install and use?", arranged in descending order*

A statistically significant difference in the attitudes towards the use of applications related to COVID-19 between the two study periods was found in the types of virus spread tracking and social support, where the users' interest showed a significant decline, and in the level of computer skills – in the attitudes towards the applications for virus spread tracking and social support (table 21). In the other factors, respondents' gender, age groups and education, no statistically significant difference was found.

Table 21. *Comparison of the answers to the question "Which one of the following applications related to COVID-19 would you install and use?" by stage and level of computer skills*

Symptom tracking			
	yes *n (%)*	*no* *n (%)*	*total* *n (%)*
total	**138 (44.70)**	**171 (55.30)**	**309 (100.00)**
stage			
S1	65 (40.10)	97 (59.90)	162 (100.00)
S2	73 (49.70)	74 (50.30)	147 (100.00)
P-value	χ^2=2.84 df=1 P=0.092		
computer literacy level			
beginner's	8 (36.40)	14 (63.60)	22 (100.00)
intermediate	75 (49.70)	76 (50.30)	151 (100.00)
good	55 (40.40)	81 (59.60)	136 (100.00)
P-value	χ^2=3.13 df=2 P=0.210		
Virus spread tracking			
	yes *n (%)*	*no* *n (%)*	*total* *n (%)*
total	**139 (45.00)**	**170 (55.00)**	**309 (100.00)**
S1	95 (58.60)	67 (41.40)	162 (100.00)
S2	44 (29.90)	103 (70.10)	147 (100.00)
P-value	χ^2=25.67 df=1 **P=0.0001**		
computer literacy level			
beginner's	4 (18.20)	18 (81.80)	22 (100.00)
intermediate	82 (54.30)	69 (45.70)	151 (100.00)
good	53 (39.00)	83 (61.00)	136 (100.00)
P-value	χ^2=13.67 df=2 **P=0.001**		
Social support			
	yes *n (%)*	*no* *n (%)*	*total* *n (%)*
total	**87 (28.20)**	**222 (71.80)**	**309 (100.00)**
stage			
S1	59 (36.40)	103 (63.60)	162 (100.00)
S2	28 (19.00)	119 (81.00)	147 (100.00)
P-value	χ^2=3.13 df=2 P=0.210		
computer literacy level			
beginner's	2 (9.10)	20 (90.90)	22 (100.00)
intermediate	52 (34.40)	99 (65.60)	151 (100.00)
good	33 (24.30)	103 (75.70)	136 (100.00)

P-value	χ^2=7.92 df=2 **P=0.019**		
I would not use			
	yes *n (%)*	*no* *n (%)*	*total* *n (%)*
total	**73 (23.60)**	**236 (76.40)**	**309 (100.00)**
stage			
S1	45 (27.80)	117 (72.20)	162 (100.00)
S2	28 (19.00)	119 (81.00)	147 (100.00)
P-value	χ^2=3.13 df=2 P=0.210		
computer literacy level			
beginner's	8 (36.40)	14 (63.60)	22 (100.00)
intermediate	26 (17.20)	125 (82.50)	151 (100.00)
good	39 (28.70)	97 (71.30)	136 (100.00)
P-value	χ^2=7.34 df=2 **P=0.026**		

Indicator 3 – Attitudes towards the use of 24/7 online platform help related to COVID-19

To explore the respondents' preferences for the types of COVID-19 consultations offered by a 24/7 online platform, the users were offered the options *diagnosis*, *health advice*, *treatment*, and a "*I would not use*" option. Again, the question was of the multiple choice type.

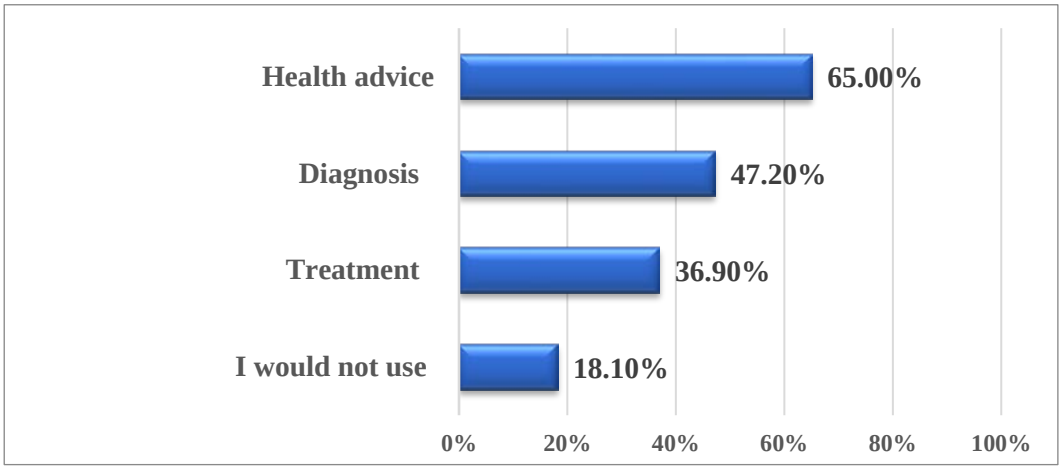

Figure 16. *Distribution of the answers to the question "If you seek help from a 24/7 online platform related to COVID-19 consultations, it will be for:" arranged in descending order*

The analysis of the attitudes compared in the two stages showed that the users' interest in the *diagnosis* application decreased considerably over time, while that in the *treatment* application significantly increased. Statistically

significant differences were found depending on the respondents' computer literacy level. Those having a beginner's level of computer skills were the least interested in using the *diagnosis* application. The same group also had the largest significant share among the users who would not use such applications (table 22).

Table 22. *Comparison of the answers to the question "If you seek help from a 24/7 online platform related to COVID-19 consultations, it will be for:" by stage and level of computer skills*

Diagnosis			
	yes *n (%)*	*no* *n (%)*	*total* *n (%)*
total	**146 (47.20)**	**163 (52.80)**	**309 (100.00)**
stage			
S1	86 (53.10)	76 (46.90)	162 (100.00)
S2	60 (40.80)	87 (59.20)	147 (100.00)
P-value	χ^2=4.66 df=1 P=0.031		
computer literacy level			
beginner's	4 (18.20)	18 (81.80)	22 (100.00)
intermediate	72 (47.70)	79 (52.30)	151 (100.00)
good	70 (51.50)	66 (48.50)	136 (100.00)
P-value	χ^2=8.44 df=2 **P=0.015**		
Health advice			
	yes *n (%)*	*no* *n (%)*	*total* *n (%)*
total	**201 (65.00)**	**108 (35.00)**	**309 (100.00)**
stage			
S1	100 (61.70)	62 (38.30)	162 (100.00)
S2	101 (68.70)	46 (31.30)	147 (100.00)
P-value	χ^2=1.65 df=1 P=0.199		
computer literacy level			
beginner's	14 (63.60)	8 (36.40)	22 (100.00)
intermediate	101 (66.90)	50 (33.10)	151 (100.00)
good	86 (63.20)	50 (36.80)	136 (100.00)
P-value	χ^2=0.44 df=2 P=0.802		
Treatment			
	yes *n (%)*	*no* *n (%)*	*total* *n (%)*
total	**114 (36.90)**	**195 (63.10)**	**309 (100.00)**
stage			
S1	48 (29.60)	114 (70.40)	162 (100.00)

S2	66 (44.90)	81 (55.10)	147 (100.00)
P-value	χ^2=7.72 df=1 **P=0.005**		
computer literacy level			
beginner's	6 (27.30)	16 (72.70)	22 (100.00)
intermediate	62 (41.10)	89 (58.90)	151 (100.00)
good	46 (33.80)	90 (66.20)	136 (100.00)
P-value	χ^2=2.55 df=2 P=0.279		
I would not use			
	yes *n (%)*	*no* *n (%)*	*total* *n (%)*
total	**56 (18.10)**	**253 (81.90)**	**309 (100.00)**
stage			
S1	29 (17.90)	133 (82.10)	162 (100.00)
S2	27 (18.40)	120 (81.60)	147 (100.00)
P-value	χ^2=0.11 df=1 P=0.915		
computer literacy level			
beginner's	8 (36.40)	14 (63.60)	22 (100.00)
intermediate	22 (14.60)	129 (85.40)	151 (100.00)
good	26 (19.10)	110 (80.90)	136 (100.00)
P-value	χ^2=6.31 df=2 **P=0.043**		

The χ^2 criterion applied to the assessment of the influence of the gender, age group and education factors on the results of the respondents' answers did not show statistically significant differences.

Indicator 4 – preferences in the choice of a medical consultation during an emergency situation

In order to track the dynamics of the respondents' attitudes in the course of the pandemic regarding their preferred way of receiving a medical consultation, three potential options were suggested: in-person (physical visit) to a medical professional, telephone consultation and online consultation through applications such as Viber, Skype, Messenger or others, the question being of the multiple choice type. The distribution of the results has been presented in fig. 17.

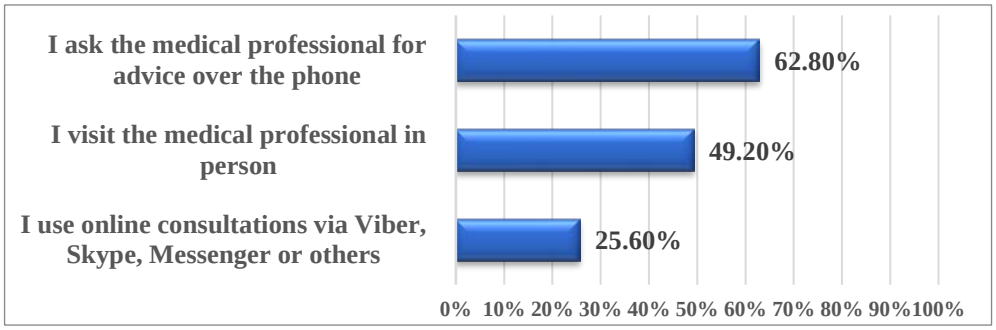

Figure 17. *Distribution of the answers to the question "In view of the current situation, how would you proceed if you needed a medical consultation?" arranged in descending order*

An analysis was performed of the respondents' preferences between the two stages and the results have been shown in table 23.

Table 23. *Comparison of the answers to the question "In view of the current situation, how would you proceed if you needed a medical consultation?" by stage*

I visit the medical professional in person			
	yes *n (%)*	*no* *n (%)*	*total* *n (%)*
total	**152 (49.20)**	**157 (50.80)**	**309 (100.00)**
stage			
S1	73 (45.10)	89 (54.90)	162 (100.00)
S2	79 (53.70)	68 (46.30)	147 (100.00)
P-value	χ^2=2.32 df=1 P=0.127		
I ask the medical professional for advice over the phone			
	yes *n (%)*	*no* *n (%)*	*total* *n (%)*
total	**194 (62.80)**	**115 (37.20)**	**309 (100.00)**
stage			
S1	102 (63.00)	60 (37.00)	162 (100.00)
S2	92 (62.60)	55 (37.40)	147 (100.00)
P-value	χ^2=0.01 df=1 P=0.945		
I use online consultations via Viber, Skype, Messenger or others			
	yes *n (%)*	*no* *n (%)*	*total* *n (%)*
total	**79 (25.60)**	**230 (74.40)**	**309 (100.00)**
stage			
S1	43 (26.50)	119 (73.50)	162 (100.00)
S2	36 (24.50)	111 (75.50)	147 (100.00)
P-value	χ^2=0.171 df=1 P=0.679		

No statistically significant difference was found in the respondents' preferences for medical consultations between the two stages of the study. With regard to the other characteristics, gender, age group, education and computer literacy level, no significant differences were found, either.

3. Comparative analysis of the GPs' attitudes towards electronic healthcare and their dynamics in the 2020 – 2022 period

In order to trace the GPs' attitudes during the 2020 – 2022 period, when a number of EH functionalities were introduced, the results of two studies were analysed and compared. The first one was conducted in 2020 at a working meeting of the National Association of General Practitioners in Bulgaria (NAGPB) and the Association of General Practitioners – Plovdiv dedicated to vaccine prophylaxis, where the paper-based questionnaire was distributed. For the second one, conducted in 2022, the GP results of the study of the medical professionals' attitudes were used.

For the purposes of the comparative analysis, the respondents were divided into two groups for the presentation of the results according to the time of the study as follows:

- GP2020: respondents from the 2020 study;
- GP2022: respondents from the 2022 study.

Characteristics of the groups studied

In the first study, 200 questionnaires were distributed, 66 of which (n = 66) were filled out. The second study elicited answers from 87 respondents, 77 of whom (n = 77) were included in the comparative analysis in order to ensure compliance by gender and age of the two samples studied. The demographic characteristics of the groups studied have been presented in table 24.

Table 24. *Characteristics of the demographic data of the groups studied*

Characteristics	**total**	**GP2020**	**GP2022**	**P**
	n=143 (100%)	**n=66 (46.20%)**	**n= 77 (53.80%)**	
Gender	*n, (%)*	*n, (%)*	*n, (%)*	*χ^2, df, P*
Men	52 (36.40)	21 (31.80)	31 (40.30)	χ^2=1.09, df=1, P=0.296
Women	91 (63.60)	45 (68.20)	46 (59.70)	
Age				*t, df, P*

Min.	27	27	30	t=1.94, df=141, P=0.054
Max.	67	67	65	
Mean (±SEM)	54.28 (±0.66)	52.91 (±1.10)	55.45 (±0.77)	
Work experience				*t, df, P*
Min.	1	1	2	t=3.51, df=141, **P=0.001**
Max.	43	42	43	
Mean (±SEM)	22.62 (±0.80)	19.71 (±1.19)	25.10 (±0.99)	

The gender distribution demonstrated the prevalence of women (the women to men ratio was 2:1), which was preserved in both samples tested. The respondents' age varied from 27 to 67 years, with an average age of 54.28 (± 0.66). There was no statistically significant difference in the respondents' average age.

The results on the respondents' computer skills and the use of Internet have been presented in table 25.

Table 25. *Characteristics of the GPs' computer skills and frequency of Internet use*

Characteristics	**total** **n=143 (100%)**	**GP2020** **n=66 (46.20%)**	**GP2022** **n= 77 (53.80%)**	**P**
Computer skills	*n, (%)*	*n, (%)*	*n, (%)*	*χ^2, df, P*
beginner's level	8 (5.70)	5 (7.80)	3 (3.90)	χ^2=6.48 df=2 **P=0.039**
intermediate level	66 (46.80)	36 (56.30)	30 (39.00)	
good level	67 (47.50)	23 (35.90)	44 (57.10)	
Internet use at the workplace	*n, (%)*	*n, (%)*	*n, (%)*	*χ^2, df, P*
I do not use it	0 (0)	0 (0)	0 (0)	χ^2=0.50 df=1 P=0.826
I rarely use it	4 (2.90)	2 (3.20)	2 (2.60)	
I use it every day	135 (97.10)	60 (96.80)	75 (97.40)	

All respondents used a computer, and 8 respondents (5.70%) self-identified at a beginner's computer skill level. 66 of the respondents (46.80%) had an intermediate skill level, and 67 (47.50%) self-assessed their computer skill level as good. A statistically significant difference in computer literacy (P=0.039) was established between the individual groups. More than half of the GP_{2022} had good computer skills, while a similar share of GP_{2020} were characterised by an intermediate level of computer skills.

The Internet use by the GP was high: 135 (97.10%) stated that they used the Internet every day at their workplace, with no statistically significant difference established between the two groups.

Analysis of the attitudes of the general practitioners from Group 1 (2020) towards electronic healthcare

In order to examine the attitude of GP_{2020} towards EH, the respondents were offered 17 statements about the usefulness and difficulties involved in the use of the EH components by physicians, the benefit to patients and the impact on healthcare delivery. A 4-point Likert scale was used to evaluate the statements, including the categories "fully disagree", "disagree", "agree" and "fully agree".

The percentage distribution of the answers to the statements, arranged in descending order by the total share of agreement, has been presented in fig. 18.

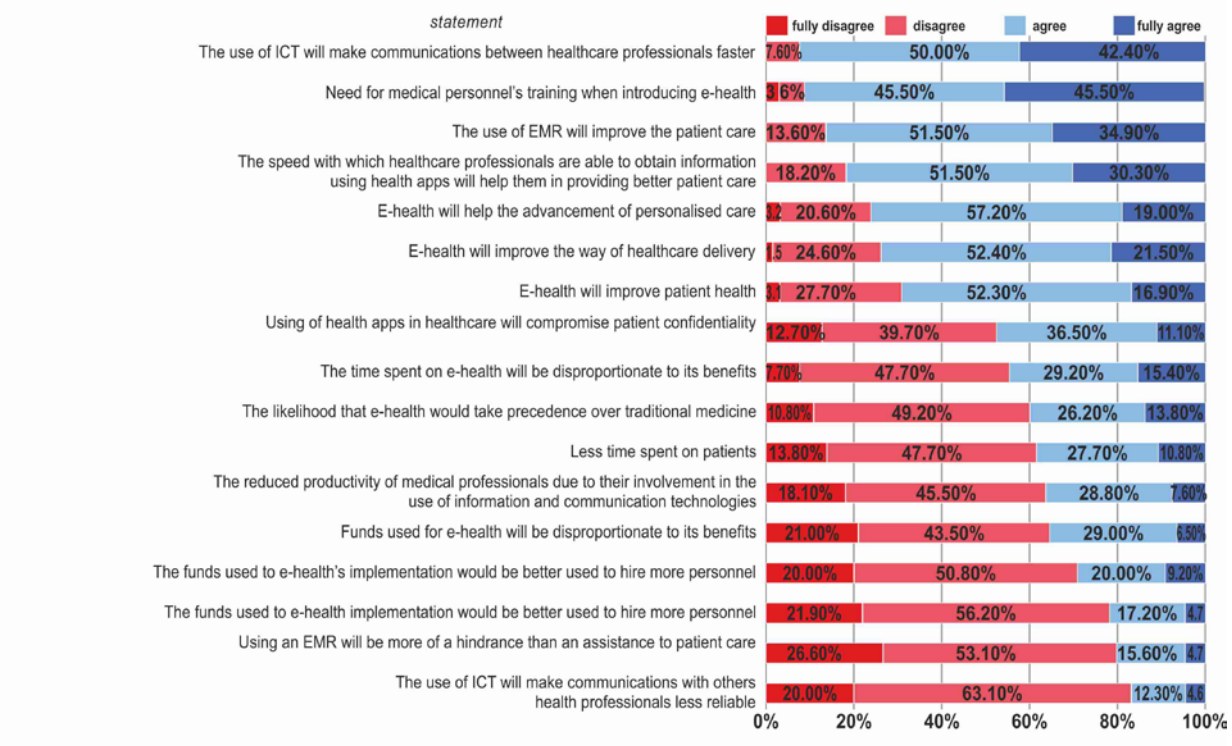

Figure 18. *Percentage distribution of the statements, arranged in descending order by the relative share of people who agreed with the respective statement*

The results indicated a very positive attitude among GP towards the expected benefits of EH. The most prominent potential benefits of EH in this study included *improved communication between medical professionals* (92.40%), *improved patient care through the use of EMR* (86.40%), and *timely information from health*

applications (81.80%). The share of GP who emphasised the *need for training when introducing EH* (95.10%) was particularly large. More than two-thirds of the respondents believed that *EH would help the advancement of personalised care* (76.20%), *improve the way healthcare is delivered* (73.90%) and *improve patient health* (69.20%).

Statements about the GPs' concerns related to the introduction of EH were rated with a lower degree of agreement than the statements about the benefits. The leading concerns were *compromised patient confidentiality* (47.60%), *less time spent on patients* (44.60%) and *the likelihood that EH would take precedence over traditional medicine* (40.00%). The *funds spent disproportionately in relation to the benefits of EH* (35.50%) and *the reduced productivity of medical professionals due to their involvement in the use of information and communication technologies* (36.40%) were even less strong. Regarding expectations related to EMR, they were in a positive direction, as only 20.30% believed that it would be more of a hindrance than of assistance in patient care.

The free answers regarding the respondents' attitude to EH were dominated by positive opinions and the attitudes that "they have wanted it for a long time" and "it will improve and facilitate the GPs' work. The pessimistic opinions were related to "less patient contact time, more documentation" and "suspected EMR abuse and false case summary." Only one respondent stated categorically that he was against EH, and another one expressed the opinion that EH introduction would not take place.

In order to explore the attitudes of GP_{2020} towards the use of online health sites, forums and health information, the respondents were offered 10 statements which they had to rate along a five-point Likert scale from "fully disagree" to "fully agree". For the purposes of the comparison, we combined the categories "fully disagree" with "disagree" and "agree" with "fully agree". Arranged by the relative share of "agree", the percentage distributions of the results of the statement evaluations have been presented in fig. 19.

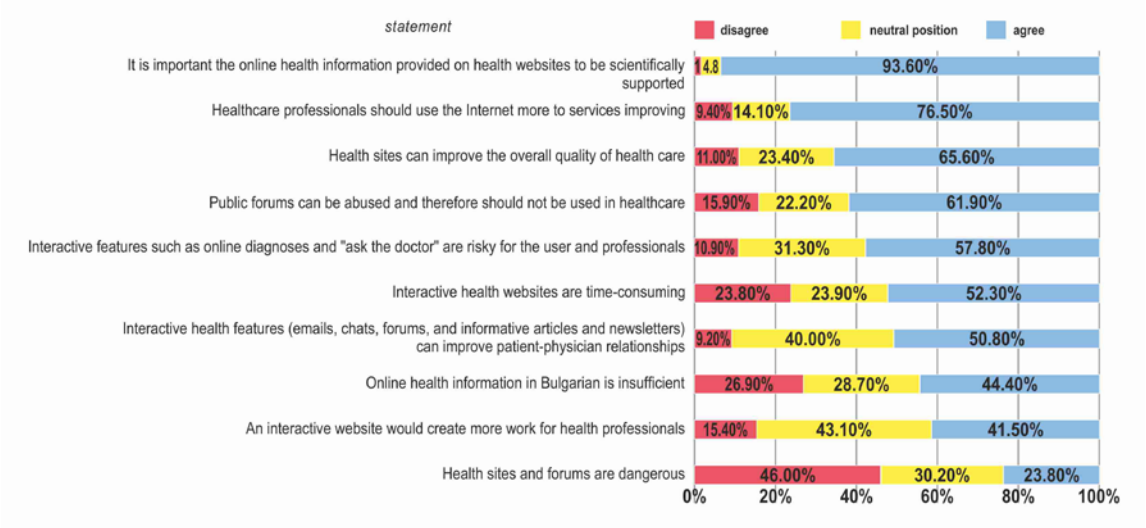

Figure 19. *Percentage distribution of the statements regarding the use of health sites, forums and health information online by relative share of the people who agreed with the respective statement*

24 respondents (39.40%) filled in an opinion in the open-ended response box about their attitude towards the use of health sites, forums and health information online. Most opinions were in a positive direction about using health information online, but only if it was scientifically supported or at least controlled by the relevant institutions.

Easier access to health information online puts consumers in a position of empowerment regarding their own health. Ready to become partners in the care for and maintenance of their own health and to take advantage of online processes, health portals and physicians' web pages and e-mail, this new generation of consumers is slowly redefining the doctor-patient relationship.

Comparative analysis of the GPs' attitudes towards EH before and after the launch of the NHIS

For the purposes of the comparative analysis of the GPs' attitudes in the 2020 – 2022 period before and after the launch of the NHIS in Bulgaria, four evaluation criteria related to the potential benefits and three about the negative consequences of the implementation of EH in Bulgaria were selected and compared from the two surveys conducted (table 26).

Table 26. *Criteria for evaluation of the GP's attitudes in the 2020 – 2022 period*

Potential benefits of EH implementation
Improved healthcare quality
Improved patient care with the use of EMR
Improved communication between healthcare specialists
Development of personalised care
Concerns about EH implementation
Need for training when new EH modules are implemented
Shortage of time for patients due to working with EH
EH precedence over traditional healthcare

The relative share of the positive answers to the statements (the "agree" and "fully agree" categories were combined) was used for the comparison. The comparison between the results of the two periods for the considered potential benefits of EH and concerns related to its implementation showed that the percentage of all four positive attitudes had significantly decreased, while in two of the three attitudes related to concerns, it had significantly increased (table 27).

Table 27. *Comparison of the relative share of the positive evaluations of the statements related to potential benefits and concerns between 2020 and 2022*

statement	**GP 2020** *agree (n=66)* *number (%)*	**GP 2022** *agree (n=77)* *number (%)*	***t, P***
Expected benefits			
Improved healthcare quality	48 (73.80)	16 (20.80)	t=7.24, **P<0.001**
Improved patient care with the use of EMR	57 (86.40)	23 (29.90)	t=8.42, **P<0.001**
Improved communication between healthcare specialists	61 (92.40)	29 (37.70)	t=8.54, **P<0.001**
Development of personalised care	48 (76.20)	13 (16.90)	t=8.04, **P<0.001**
Concerns			
Need for training when new EH modules are implemented	60 (90.90)	46 (59.70)	t=4.71 **P<0.001**
Shortage of time for patients due to working with EH	25 (38.50)	54 (70.10)	t=3.26 **P<0.01**

EH precedence over traditional healthcare	26 (39.40)	52 (68.40)	t=3.50 **P<0.001**

The attitudes towards the four expected benefits surveyed across the two stages of the study marked a drastic drop for 2022, with a difference of over 50.00% in each. It was the greatest, 59.30%, in "*development of personalised care*". The expected benefits of using EMR were lower, at 56.50%, with 54.70% for improved communication between healthcare specialists, and 53.00% for improved healthcare quality.

Since the second survey on the attitudes of the 2022 GP was conducted in the period when the NHIS modules were introduced and used by doctors, it can be argued that the decline in positive attitudes was a consequence of the actual use of the EH functionalities, which did not meet the 2020 expectations of benefits. The expectations for easier administrative activities of GP through EH implementation actually proved an additional burden and very time consuming, which was evident from the significant increase in the share of people agreeing with the concerns "*Shortage of time for patients due to working with EH*" and "*EH precedence over traditional healthcare*", the difference being 31.60% and 29.00% more in 2022, respectively. In addition, GP were among the first medical professionals to use the NHIS modules, and suffered from the initial malfunctions of the system: each new technology and launch of EH functionalities were accompanied by difficulties. Despite the gradual introduction of the NHIS modules, the technical problems were not uncommon and the GPs' concern was justified since quite a few inconveniences occurred in their work.

CONCLUSIONS

1. The medical professionals' attitudes towards electronic healthcare were focused more on the concerns about its implementation rather than on its potential benefits.
2. The most expected benefits stated by the medical professionals were oriented towards overall improvements in the healthcare system: better communication and coordination between the individual levels in the healthcare sector, more information for public health purposes and avoidance of unnecessary or repeated tests. The attitudes were most sceptical about the expected improved treatment quality, especially among women, who were more pessimistic about the formulation of more accurate diagnoses, the reduction of medical errors, and the provision of more information on clinical research and public health. Age was also a determining factor in positive attitudes: with regard to all potential benefits, medical professionals under the age of 50 had more optimistic expectations. The GP were more sceptical about the benefits compared to the other specialist groups surveyed.
3. The medical professionals' main concerns related to the EH implementation are the **risk of system failure**, GP expressing the greatest concern; the **lack of time** and the **lack of training of health personnel regarding digital health technologies**, as well as the **lack of regulated payment for electronic health services**. Medical professionals over the age of 50 experienced significantly stronger concerns about the lack of time and the likelihood that EH would take precedence over traditional healthcare.
4. The most common remote healthcare services were the delivery of test results and prescriptions to patients through mobile communication applications (Viber, Skype, Messenger, etc.). GP were the group of specialists with the largest share of consultations provided online, but also with the smallest share of tracking a patient's health behaviour through the MHA. SD conducted the largest number of consultations with other specialists from a distance. The predominant share of medical professionals would recommend MHA to their patients, GP being the least likely to make such recommendations. However, to date, most medical professionals have not used MHA to monitor patients in their practice.
5. Medical professionals, GP in particular, were still too sceptical about seeking health information from their patients online.
6. Among the general public, the positive attitude towards the use of digital health technologies was clearly expressed in 66.70% of the respondents. This attitude was maintained even during the pandemic. Age and education had an effect on the users' attitude towards the application of DHT by health

institutions. Users above 30 years of age, with higher education and good computer skills, showed significantly greater interest in online health services.

7. While the attitudes of the 2020 GP demonstrated not only a strong positive opinion about the benefits of EH, but also a desire for its more rapid introduction, in 2022, when this happened with the launch of NHIS modules, the attitudes changed dramatically: they were more on the negative side, with clearly expressed concerns about EH implementation. The GPs' expectations for administrative relief through digital functionalities turned out an additional burden and time commitment.
8. The GPs' attitudes towards health sites, forums and health information online were positive in 2020. However, the GP expressed their negative attitudes and strong concerns related to the use of this information by patients.

RECOMMENDATIONS

The following recommendations to health institutions have been formulated:

1. Sufficient information should be provided about the potential benefits rated low by medical professionals.
2. Efforts should be directed towards overcoming the causes of the concerns.
3. The public should be kept informed about the electronic healthcare functionalities introduced, and the existing mobile health applications should be promoted.

Recommendations to the educational institutions:

1. Adequate training needs to be ensured, which would lay the foundations for the use of information technologies in EH, along with subsequent continuous training in professional practice.
2. Digital health literacy should be formed and developed in the users of electronic healthcare.

Recommendations to government institutions:

1. Creation of a regulatory framework for electronic healthcare and telemedicines
2. Ensuring payment regulation for the services in digital healthcare.

Recommendations for electronic healthcare functionality developers:

1. Consultations with medical personnel during the development of new functionalities of electronic healthcare
2. Provision of technical support, available at all times, for the successful use of electronic health services by health personnel.

CONTRIBUTIONS

The following more important contributions of scientific and applied nature have been formulated:

1. An in-depth study of the main groups of electronic healthcare users in Bulgaria has been conducted, including the general public and medical professionals.

2. The expectations and concerns of individual groups of medical professionals in relation to the introduction of electronic healthcare have been studied and compared. The most expected benefits and the most problematic aspects of its implementation have been outlined. An analysis has been made of the effect of gender, age and specialty on the attitudes of the groups of medical professionals studied.

3. A comparison has been made of the general practitioners' attitudes before and after the introduction of electronic healthcare: after actual use of the functionalities of the National Health Information System.

4. The impact of electronic health care and information technology on doctor-patient relationships has been studied.

5. Conclusions and recommendations have been formulated for the creation of a regulatory framework for electronic healthcare and telemedicine, as well as for the formation and development of digital health literacy in electronic healthcare users.

PUBLICATIONS RELATED TO THE DISSERTATION

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