The Acceptance of e-Health Solutions Among Patients with Chronic Respiratory Conditions

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Abstract

Objective: The main objective of this study was to assess the acceptance of the use of e-health applications by patients suffering from bronchial asthma and other chronic respiratory conditions.

Subjects and Methods: The questionnaire, consisting of 73 items, was distributed among 200 patients remaining under the care of a tertiary-care pulmonology center in Krakow, Poland (return rate, 82.5%; n=165). **Results:** The mean age (standard deviation) of respondents was 50.8 (14.9) years. Of the respondents, 48.5% (n=80) suffered from bronchial asthma, 29.1% (n=48) from chronic obstructive pulmonary disease, and 32.1% (n=53) from other respiratory diseases. The Internet was used by 58.2% (n=96) of respondents. The most frequent types of health-related information searched for online included diseases (59.4%) and treatments (medication, 54.2%; treatment options, 58.3%), as well as information about physicians and healthcare institutions (32.3% and 31.3%, respectively). The differences between acceptance scores for specific e-health applications were significant (analysis of variance, Friedman chi-squared=166.315, $p<0.001$). The respondents revealed the highest acceptance of e-health solutions allowing them to book appointments with physicians, access laboratory test results, view educational resources, and renew prescriptions. The acceptance of the most popular e-health applications depended on the duration of disease, respondent's age and education, and his or her use of computers and the Internet. **Conclusions:** Patients suffering from chronic respiratory conditions demonstrate higher levels of acceptance of e-health applications such as appointment booking, prescription renewal, and access to information (laboratory test results, educational resources) than of solutions directly related to medical care (communication with healthcare providers, disease monitoring).

Key words: e-health, Internet use, chronic disease, respiratory medicine, asthma

Introduction

Chronic diseases are fast becoming one of the key challenges for modern healthcare systems. The prevalence and morbidity related to chronic medical conditions have been increasing steadily throughout the 20th century. Estimates

indicate that the percentage of people with at least one chronic condition living in modern societies could reach as much as 40%.¹ Efficient management of chronic diseases requires regular interactions between patients and their healthcare providers. This results in considerable spending on regional and national scales. It is estimated that expenditure on chronic diseases may reach as much as 80% of healthcare budgets in developed countries.² Chronic respiratory disorders, including bronchial asthma and chronic obstructive pulmonary disease, are common in modern societies.³⁻⁵

The expansion of e-health solutions is associated with the increasing demand for flexible, comprehensive, and cost-effective chronic care models.⁶⁻¹⁰ The scope of the applications that can be used to support patients suffering from chronic conditions is broad.^{11,12} As well as having access to educational resources, chronic disease patients can use various types of e-diaries and systems for long-term monitoring of the disease course. Depending on the disease and symptoms, the types of devices used to assess the patient's condition vary; however, the need to report the symptoms and measurements remains the same.

It is clear that the success of chronic disease therapies depends on the patient's involvement in the process of disease monitoring and management. The emphasis on the role of the patient parallels the general trend of involving people and patients in decisions made about their health.^{13,14}

Most patients with chronic conditions do not require complicated monitoring procedures. Subjective assessment of the disease course and certain simple measurements, such as the peak expiratory flow rate in bronchial asthma or blood glucose in diabetes, remain the mainstay of effective monitoring.¹⁵⁻¹⁷ Involving patients in monitoring their own symptoms leads to improved awareness and competence in disease management.¹⁸⁻²⁰

Widespread use of e-health systems in chronic care depends on several factors; the acceptance and ability to use information technology tools are of key importance, alongside understanding of the disease and therapeutic measures.²¹ Thus, the feasibility of e-health applications in relation to specific patient groups or communities should also be assessed in the context of developing an information society in the country.²²

The main objective of this study was to assess the readiness of patients suffering from bronchial asthma and other chronic respiratory disorders for the benefits of e-health systems. To achieve this goal, the use of information technologies and the acceptance of their use in the provision of healthcare services were analyzed in patients with chronic respiratory conditions remaining under the care of a tertiary-care medical center. Furthermore, the degree of acceptance

of different types of e-health applications was ranked according to patients' views.

Subjects and Methods

The questionnaire used in the survey collected data on the burden related to chronic diseases, general computer and Internet use and skills, the use of information and communication technologies for health-related activities, the acceptance of general and specific on-line healthcare services, and sociodemographic data.

The questionnaire was developed to assess the potential problems faced by chronic disease patients and the scope of e-health applications they may find useful. The questionnaire was tested in a group of 10 patients with chronic conditions, following which some modifications to improve clarity were introduced. The final version of the questionnaire consisted of 73 items. For items asking for respondents' opinions, a 5-point Likert scale was used (from strongly disagree to strongly agree, with neutral in the middle position). For items asking about the frequency of specific events or activities, relevant frequency scales were provided. Items asking about computer and Internet use, as well as specific health-related online activities, required dichotomous yes/no response. The questionnaire also contained items related to sociodemographic features (respondent age, gender, education, place of residence and marital status). The questionnaires were distributed among patients admitted to the Department of Pulmonology, Jagiellonian University Medical College, Krakow, Poland, or attending the pulmonary polyclinics at the Department. Only patients with an established diagnosis of a chronic disease with an established treatment were recruited to the survey. Patients who were hospitalized or admitted to polyclinics for diagnosis of new symptoms were not included in the study, unless they had previously been diagnosed with a chronic disease. The study was initiated in early December 2011 and completed in February 2012.

Respondents were provided with comprehensive information about the objectives and scope of the survey and asked to give their consent to participate in the study. The questionnaires were distributed by canvassers trained especially for the study. The respondents were able to obtain further information from the canvassers before completing the questionnaire. The study protocol was approved by the Bioethical Committee at the Jagiellonian University (decision number KBET/107/B/2011 from June 30, 2011).

Statistical analysis was performed using Statistica version 10 PL software (StatSoft Inc., Tulsa, OK). The variables following normal distribution were presented as mean (standard deviation) values. If not stated otherwise, the frequency of an available response option to a specific item was given as a percentage of all valid responses excluding missing responses. The differences in ranked values for several variables representing the same subject were assessed using Friedman's two-way analysis of variance. If it was significant, the comparison between every two variables was performed using the nonparametric Wilcoxon signed rank test. The Kruskal-Wallis test was used in the assessment of the differences between variables assuming ranked values depending on the categories of grouping variables. The differences between scores assigned to variables within

the categories of grouping variables assuming two categories of response were assessed using the Mann-Whitney U test. The level of statistical significance was assumed as 0.05.

The age categories were established using median and lower and higher quartile values. The same rule was used to categorize the duration of the chronic condition. The item asking about the respondents' education included nine options, from basic to university level, specific to the Polish education system. The nine levels were collapsed into three categories: (A) education level lower than upper secondary according to the International Standard Classification of Education (ISCED); (B) education level including upper secondary to post-secondary non-tertiary according to the ISCED; and (C) education level covering all levels according to ISCED higher than post-secondary non-tertiary.²³

Results

CHARACTERISTICS OF THE RESPONDENTS

The questionnaires were distributed to 200 patients treated on an outpatient basis or hospitalized at the Department of Pulmonology, Jagiellonian University Medical College, because of chronic disease of the respiratory system. In total, 165 questionnaires were completed and returned by respondents (response rate, 82.5%). Sixty percent ($n=99$) of the respondents were women. The mean (SD) age of respondents was 50.5 (14.9) years: 50.8 (14.6) years among women and 50.0 (15.6) years among men. The percentage of patients with bronchial asthma was 48.5% ($n=80$), with 29.1% ($n=48$) having chronic obstructive pulmonary disease and with 32.1% ($n=53$) having other chronic respiratory disorders. Further information about the respondents who participated in the survey is provided in Table 1.

THE USE OF COMPUTERS AND THE INTERNET

A majority of the respondents (66.6%; $n=110$) declared they used a computer, and 58.2% ($n=96$) stated that they used the Internet without help from other people. Of the respondents who used computers, 10.2% ($n=11$) had been using them for up to 2 years, 27.8% ($n=30$) for >2 to 5 years, 25.9% ($n=28$) for >5 to 10 years, and 36.1% ($n=39$) for more than 10 years. As for the duration of Internet use, 8.5% ($n=8$) had been using the Internet for up to 2 years, 33.0% ($n=31$) for >2 to 5 years, 31.9% ($n=30$) >5 to 10 years, and 26.6% ($n=25$) for over 10 years. Regarding Internet access, 56.4% ($n=53$) of respondents stated they used it every day, 30.9% ($n=29$) used it several times per week, and 9.6% ($n=12$) used the Internet less frequently. The Internet was used for accessing the news by 84.4% ($n=81$) of Internet users, searching for information by 83.3% ($n=80$), communicating with family and friends by 55.2% ($n=53$), entertainment by 43.8% ($n=42$), participating in discussion forums by 16.7% ($n=16$), accessing social networks by 31.3% ($n=30$), searching for employment opportunities by 14.6% ($n=14$), Internet banking by 49.0% ($n=47$), and self-promotion (personal or company) by 21.9% ($n=21$).

Mobile phones were used by 88.5% ($n=146$) of respondents. Of mobile phone users, 7.1% ($n=10$) had used them for up to 2 years, 24.8% ($n=35$) for >2 to 5 years, 29.8% ($n=42$) for >5 to 10 years, and 38.3% ($n=54$) for over 10 years.

Table 1. Characteristics of the Respondents Included in the Survey (n=165)

VARIABLE	N	%
Sex		
Female	99	60.0
Male	66	40.0
Age (years) ^a		
< 39	39	24.6
≥ 39 to < 52	38	24.1
≥ 52 to < 61	41	26.0
≥ 61	40	25.3
Place of residence		
Rural	51	31.7
Urban < 100,000	36	22.3
Urban > 100,000	74	46.9
Education ^b		
Level A	61	37.4
Level B	48	29.5
Level C	54	33.1
Chronic respiratory disease		
Bronchial asthma	80	48.5
COPD	48	29.1
Other	53	32.1
Hospitalization due to chronic disease		
No	39	23.6
Yes	126	76.4
Duration (years) of chronic disease ^c		
< 5	41	24.8
≥ 5 to < 9	44	26.7
≥ 9 to < 16	41	24.8
≥ 16	39	23.6

^aThe median and quartile values of the age of respondents were calculated (median, 52 years; lower quartile, 39 years; and upper quartile, 61 years). These values were used to determine four intervals for categorizing the age of respondents.

^bThe item related to the education of the respondents included nine options, from basic to university level, specific to the Polish education system. The nine levels were collapsed into three categories: Level A, education level lower than upper secondary according to the International Standard Classification of Education (ISCED)²³; Level B, education level including upper secondary to post-secondary non-tertiary according to the ISCED; and Level C, education level covering all levels according to the ISCED higher than post-secondary non-tertiary.

^cThe median and quartile values of the duration of chronic disease in a respondent were calculated (median, 9 years; lower quartile, 5 years; and upper quartile, 16 years). These values were used to determine four intervals for categorizing the duration of disease in respondents.

COPD, chronic obstructive pulmonary disease.

THE USE OF THE INTERNET FOR A HEALTH-RELATED PURPOSE

The Internet was indicated by 29.7% ($n=49$) of all respondents and 47.9% ($n=46$) of those who were Internet users as one of the main sources of health-related information. In total, 33.6% ($n=49$) of respondents claimed that they always, frequently, or quite frequently used the Internet when searching for information about health, diseases, and treatment methods.

In terms of health-related information, the respondents most frequently searched for information about diseases (59.4%, $n=57$), medicines (54.2%, $n=52$), and treatment modalities (58.3%, $n=56$). As for the types of activities performed online at least once, the respondents most frequently checked information about physicians (32.3%, $n=31$) and healthcare institutions (31.3%, $n=30$), procedures ordered by physicians (32.3%, $n=31$), and adverse effects that may be caused by medication (31.3%, $n=30$). Other popular activities included searching for information about medication dosage and about preparing for procedures recommended by a physician (both 21.9%, $n=21$). Less popular activities included obtaining advice from other patients (16.7%, $n=16$), asking about health-related problems on forums (9.4%, $n=9$), posing questions to experts (7.3%, $n=7$), and offering of advice to other patients (just 4.2%, $n=4$).

FACTORS INFLUENCING GENERAL AND HEALTH-RELATED INTERNET USE

The use of the Internet was more frequent among respondents who were younger ($p<0.001$), lived in urban areas ($p=0.001$), and were better educated ($p<0.001$). There was no correlation with the duration of chronic disease, hospitalization due to chronic disease, or suffering from bronchial asthma or chronic obstructive pulmonary disease. Younger age and a higher education level were also associated with the declaration of the Internet as one of main sources of health-related information. Additionally, patients suffering from chronic obstructive pulmonary disease treated the Internet as such a source significantly less frequently. Detailed results of the analysis of factors influencing general and health-related Internet use are shown in Table 2.

THE ACCEPTANCE OF E-HEALTH SERVICES

The respondents were asked about their acceptance of the use of specific types of e-health applications supporting chronic care (responses using a 5-point Likert scale). The responses showing strong disagreement were assigned 0 points, and those showing strong acceptance were assigned 4 points. The analysis of variance Friedman analysis was performed on the responses obtained in relation to 11 types of e-health applications. It revealed significant differences between opinions about specific types of applications: chi-squared analysis of variance = 166.315, $n=164$, degrees of freedom (df) = 10, $p<0.001$. Mean scores and standard deviations, as well as types of applications differing significantly in the score (checked using the Wilcoxon sign test for pairs of scores), are shown in Table 3.

Using the Internet to make appointments with physicians received the highest score of all applications. Applications allowing patients to access test results, find educational resources, and renew

Table 2. Factors Influencing General and Health-Related Internet Use

VARIABLE	CATEGORY	INTERNET USE	P	INTERNET AS MAIN SOURCE OF HEALTH-RELATED INFORMATION	P
Sex ^a	Female	52.5% (52)	0.078	33.3 (33)	0.23
	Male	66.7% (44)		23.2 (16)	
Age (years) ^b	< 39	84.6% (33)	< 0.001	51.3 (20)	0.003
	≥ 39 to < 52	52.6 (20)		34.2 (13)	
	≥ 52 to < 61	63.4 (26)		22.0 (9)	
	≥ 61	37.5 (15)		15.0 (6)	
Place of residence ^b	Rural	39.2 (20)	0.001	27.5 (14)	0.70
	Urban <100,000	61.1 (22)		27.8 (10)	
	Urban >100,000	71.6 (53)		33.8 (25)	
Education ^b	Level A	27.9 (17)	< 0.001	18.0 (11)	0.03
	Level B	70.8 (34)		39.6 (19)	
	Level C	83.3 (45)		35.2 (19)	
Duration (years) of chronic disease ^b	< 5	65.9 (27)	0.60	29.3 (120)	0.87
	≥ 5 to < 9	59.1 (26)		34.1 (15)	
	≥ 9 to < 16	51.2 (21)		29.3 (12)	
	≥ 16	56.4 (22)		25.6 (10)	
Hospitalization due to chronic disease ^b	No	48.7 (19)	0.20	33.3 (130)	0.56
	Yes	61.1 (77)		28.6 (36)	
Bronchial asthma ^a	No	55.3 (47)	0.53	23.5 (20)	0.09
	Yes	61.3 (49)		36.3 (29)	
COPD ^a	No	62.4 (73)	0.12	36.8 (43)	0.002
	Yes	47.9 (23)		12.5 (6)	

^aThe differences between the categories were assessed with Fisher's exact test.

^bThe differences between the categories were assessed with Pearson's chi-squared test.

COPD, chronic obstructive pulmonary disease.

prescriptions were also assessed as important, as were online repositories of medical documentation. The lowest acceptance was given to e-health solutions monitoring physiological parameters, consultations with physicians, and ongoing online contact with healthcare professionals to report on current disease status.

FACTORS AFFECTING THE ACCEPTANCE OF THE MOST POPULAR E-HEALTH APPLICATIONS

The top scoring e-health applications were assessed for factors affecting their acceptance. The analysis included applications for making appointments with a physician online, accessing laboratory test results, and educational resources for patients. Factors included in the analysis were age, education, place of residence, duration of chronic disease, hospitalization due to the chronic disease, and

computer and Internet use. The results of the analysis with mean (standard deviation) scores for top e-health applications within subcategories of grouping variables are shown in *Table 4*.

Discussion INFORMATION AND COMMUNICATION TECHNOLOGIES USE

The prevalence of computer and Internet users (66.6% and 58.2%, respectively) among respondents recruited for our study corresponds with results on the use of the Internet by individuals in Poland obtained by EUROSTAT (65%).²⁴ These levels indicate that the use of the Internet for healthcare services may be limited to no more than 60% of patients with chronic respiratory diseases. Among Internet users, just 58.5% had been using it for over 5 years. Thus, approximately

Table 3. Ranking List of Respondents' Acceptance of e-Health Applications

NUMBER	TYPE OF E-HEALTH APPLICATIONS FOR PATIENTS	MEAN SCORE ^a	SD	TYPES OF APPLICATIONS WITH STATISTICALLY DIFFERENT SCORES ^b
1	Booking of appointments with physicians	2.86	1.16	2–11
2	Access to laboratory test results	2.61	1.12	1, 7–11
3	Provision of educational resources	2.52	1.09	1, 11
4	Electronic renewal of prescriptions	2.50	1.25	1, 10, 11
5	Personal repository of medical documentation	2.45	1.09	1, 11
6	Electronic diary for reporting symptoms	2.38	1.07	1, 11
7	Regular reporting of disease status to physician	2.30	1.16	1, 2
8	Contact with healthcare provider in case of disease exacerbation	2.29	1.14	1, 2
9	Online contact with healthcare professional (nurse or physician) on an as-needed basis	2.28	1.06	1, 2, 11
10	Referral to physician	2.18	1.09	1, 2, 4
11	Remote monitoring of physiological parameters	2.02	1.05	1–6, 9

^aThe responses to items listed here were ranked on a 5-point Likert scale. For further analysis, responses showing strong disagreement were assigned a value of 0, and those showing strong acceptance were classed as 4.

^bThe numbers of applications that received statistically different scores in *post hoc* comparison of pairs of e-health applications with the sign test after Bonferroni's adjustment.

SD, standard deviation.

40% of the respondents who were Internet users had been using the Internet for a relatively short time. This may further reduce their confidence in using the Internet for specific activities, including healthcare. On the other hand, 87.3% of respondents who used the Internet on their own accessed it at least several times a week. Additionally, 88.5% of respondents used mobile phones, which could be explored as another way of providing e-health services to patients.

The percentage of respondents who indicated the Internet as one of their main sources of health-related information was 29.7% among all respondents and 47.9% among Internet users in this group. The data from the EUROSTAT survey carried out in 2011 showed that health-related use of the Internet was declared by just 23% of individuals.²⁵ These findings indicate that suffering from a chronic disease resulted in an approximately 7% increase in using the Internet for health-related purposes in comparison with the general population. The results of surveys from other countries show that expected²⁶ or actual²⁷ use of healthcare services or suffering from a chronic disease^{28–30} increased the acceptance or use of the Internet for health-related services by individuals (or households). Higher disease activity and severity were also reported as factors resulting in increased Internet use for searching for disease-specific information.³¹ On the other hand, other reports indicate that subjects with a worse self-rated health status³² or suffering from medical conditions³³ declared lower use of the Internet.

Using the Internet to search for health-related information by various groups of patients has been assessed in many other studies.^{31,34–41} It is difficult to make a valid comparison with the results of these studies because the use of the Internet by specific groups of patients depends on many factors, including the type and stage of disease, time when the survey was carried out, and general Internet penetration in the given country. The use of the Internet for health-related purposes reported in these studies ranged from 16%³⁸ to 99%³⁹ of patients.

HEALTH-RELATED ACTIVITIES PERFORMED ONLINE

In our survey, the Internet was most frequently used to search for information about diseases, medication, and treatment

modalities. Such a pattern of searches reflects the main interests of people with chronic conditions. Similar patterns of online health-related information searches have been reported by other authors.^{31,35,39,42,43}

The assessment of the types of health-related activities performed online in our study demonstrated that searching for specific types of information was indicated the most frequently by respondents (more than 30% of respondents searched for possible side effects of ordered prescriptions, opinions about physicians or medical institutions, or additional information about recommended procedures). Online activities requiring more skills and interaction were less common. Approximately 17% of respondents received some advice from other patients online; however, fewer than 10% used the Internet to pose questions to experts, join a discussion forum at least once, or offer advice to others. The relatively low levels of health-related online activity among patients with chronic diseases may be a potential obstacle for their acceptance of more advanced e-health applications. The prevalence of information searching among health-related activities in the Internet was seen in the survey reported by van Uden-Kraan et al.⁴⁴ This also applies to the infrequent use of more advanced forms of interaction (e.g., joining online patient support groups or posing questions about the patient's medical condition to experts).⁴⁴

Table 4. Factors Affecting the Acceptance of the Most Popular e-Health Applications

VARIABLE	CATEGORIES	PRIORITY E-HEALTH (INTERNET-BASED) APPLICATIONS ACCORDING TO RESPONDENTS' OPINIONS					
		APPOINTMENT WITH PHYSICIAN	P	ACCESS TO LABORATORY TESTS	P	EDUCATIONAL RESOURCES	P
Sex ^a	Female	2.88 (1.20)	0.68	2.56 (1.12)	0.43	2.41 (1.03)	0.10
	Male	2.83 (1.12)		2.70 (1.14)		2.68 (1.15)	
Age (years) ^b	< 39	3.15 (1.09)	0.08	2.90 (1.10)	0.17	2.85 (1.09)	0.04
	≥ 39 to < 52	2.89 (1.13)		2.63 (1.20)		2.34 (1.05)	
	≥ 52 to < 61	3.00 (1.16)		2.68 (1.13)		2.71 (1.01)	
	≥ 61	2.50 (1.24)		2.35 (1.12)		2.23 (1.17)	
Place of residence ^b	Rural	2.69 (1.12)	0.20	2.43 (1.10)	0.19	2.43 (1.08)	0.53
	Urban < 100,000	2.97 (1.00)		2.61 (0.93)		2.58 (0.84)	
	Urban > 100,000	2.97 (1.27)		2.77 (1.23)		2.58 (1.22)	
Education ^b	Level A	2.41 (1.09)* [†]	<0.001	2.21 (1.07)*	<0.001	2.15 (1.00)*	<0.001
	Level B	3.08 (1.15)*		2.54 (1.13) [†]		2.54 (1.05)	
	Level C	3.20 (1.12) [†]		3.15 (1.00)* [†]		2.94 (1.09)*	
Duration (years) of chronic disease ^b	< 5	3.36 (0.83)	0.02	3.06 (0.95)	0.02	3.00 (0.89)*	0.01
	≥ 5 to < 9	2.61 (1.37)		2.29 (1.21)		2.29 (1.11)	
	≥ 9 to < 16	2.68 (1.06)		2.46 (1.10)		2.29 (1.01)*	
	≥ 16	3.00 (1.21)		2.77 (1.13)		2.67 (1.20)	
Admission to hospital ^a	No	2.85 (1.09)	0.78	2.62 (0.99)	0.91	2.44 (0.85)	0.51
	Yes	2.87 (1.19)		2.61 (1.17)		2.55 (1.15)	
Computer use ^a	No	2.38 (1.06)	<0.001	2.15 (0.93)	<0.001	2.09 (0.87)	<0.001
	Yes	3.10 (1.14)		2.85 (1.14)		2.74 (1.12)	
Internet use ^a	No	2.41 (1.05)	<0.001	2.25 (0.96)	<0.001	2.14 (0.90)	<0.001
	Yes	3.19 (1.14)		2.88 (1.16)		2.79 (1.13)	

Data are mean (standard deviation) values.

^aThe differences between subcategories of grouping variables were assessed using the Mann-Whitney U test to compare rank values (Likert scale) for grouping variables from two categories.

^bThe differences between subcategories of grouping variables were assessed using the analysis of variance rank Kruskal-Wallis test.

*[†]Pairs of categories of grouping variables with significant differences in the *post hoc* multiple comparisons test following the analysis of variance rank Kruskal-Wallis analysis are marked with the same symbol.

TYPES OF E-HEALTH APPLICATIONS

One of the main aims of this study was to find out which types of e-health applications are regarded as key by patients suffering from chronic respiratory disorders. From the 11 types of applications, the respondents indicated online booking of appointments with physicians, access to laboratory test results, and provision of educational resources for patients as the most relevant. Other applications holding relatively high positions in the ranking included prescription

renewals, access to personal repositories of medical documentation, and electronic diaries enabling patients to record self-observations and self-measurements. The opinions about priorities of e-health applications among respondents included in our study were strikingly similar to those described by van de Poll-Franse and van Eenbergen⁴⁵ in 2008. According to their survey, cancer survivors showed the highest acceptance of accessing their own test results (81% positive), accessing their own medical files (79%), making

appointments with physicians (68%), and requesting prescriptions (67%).

FACTORS AFFECTING THE ACCEPTANCE OF E-HEALTH APPLICATIONS

Our study demonstrated that the acceptance of the three top ranking types of applications depended on the age and education categories, duration of chronic disease, and use of computers and the Internet. Scores showing the acceptance of specific applications were higher among younger age categories. In terms of education, higher levels of education were associated with a greater acceptance of e-health applications. Furthermore, the duration of chronic disease showed a specific pattern of influence, with the highest scores among patients suffering from the diseases for less than 5 years and 16 years or longer (lower and upper quartiles). Respondents' use of computers and the Internet had a strong influence on the acceptance of e-health applications. The respondents who were computer or Internet users showed significantly higher acceptance of specific e-health solutions than nonusers. These results are to some extent consistent with the results of surveys conducted in other countries.

The influence of younger age on the use or acceptance of the Internet for health-related activities was seen among patients afflicted with cancer,^{43,45-48} inflammatory bowel disease,³⁶ and general somatic disorders.⁴⁴ The effect of higher education has also been reported for specific patient populations by many authors.^{35,45,47,49-52} This effect was also seen in surveys carried out in the general population.^{30,53,54}

The surveys conducted among patients with malignant or chronic conditions do not confirm the effect of the severity of symptoms, disease stage, or disease duration on the health-related use of the Internet.^{43,46,51,55} Our survey demonstrated that the relationship between the acceptance of e-health services and the intensity of the burden resulting from the disease (duration of chronic condition) is not straightforward. The existence of significant differences depending on the duration of chronic diseases was confirmed for specific types of applications, although *post hoc* analysis did not reveal clear differences between pairs of categories. Our study also revealed that the duration disease or hospitalization due to chronic disease was not associated with using the Internet or treating it as one of the main sources of health-related information. Unfortunately, there are no other reports on the relationship between the duration of chronic disease and the use or acceptance of e-health among other patient groups in Poland.

The respondents' gender, place of residence, and hospitalization due to chronic disease did not change their acceptance of these types of applications. Contrary to the results of our study, surveys performed among the general population usually show significant differences in terms of the use or acceptance of the Internet for health-related activities depending on sex^{27,29,30,56} or place of residence.^{27,29,54,57-59} As for hospitalization related to chronic disease, one could expect that more frequent contact with the healthcare system would increase patients' acceptance of e-health solutions. However, this was not confirmed by our study. Furthermore, the fact

of being admitted to the hospital was not associated with the use of the Internet or treating it as one of the main sources of health-related information. These findings remain in agreement with the results of a recent survey of a large sample of Polish households, which revealed that hospitalization of a member of a household did not have a significant effect on the acceptance of Internet-based provision of health services.⁵⁹

LIMITATIONS

The study had several limitations. The respondents remained under the care of a tertiary-care referral center providing pulmonary care, which could be associated with more severe or complex medical conditions in this group of chronic patients. Furthermore, the care provided by the referral centers is likely to differ from the care provided by primary or secondary care centers to patients with chronic disease. As such, the general satisfaction with healthcare services experienced by patients included in the survey is likely to be higher in comparison with views held by patients diagnosed and treated for chronic respiratory illnesses by providers from lower referral centers. This in turn could result in lower expectations for alternative modes of care provision, such as e-health solutions. The group of respondents is also relatively small, and any broad extrapolation should be treated with caution. On the other hand, to the author's knowledge, this has been the first study focused on the assessment of perceptions of patients with chronic respiratory conditions on their use of e-health solutions for care provision in Poland.

Conclusions

General and health-related use of the Internet among patients with chronic respiratory conditions remaining under the care of a tertiary-care referral center did not differ considerably from the use in the general population. As for e-health applications, the respondents revealed the highest acceptance of using the Internet to book appointments with physicians, access results of laboratory tests, use educational resources for patients, and renew prescriptions. The solutions related more directly to medical care, such as communication with healthcare professionals or monitoring of the patient's status, were less popular. The acceptance of the most popular applications differed depending on the duration of the chronic disease, age, and education categories, as well as the respondents' use of computers and the Internet.

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