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AWARENESS OF KNOWLEDGE AND INNOVATION OF EHEALTH: SIMILARITIES AND DIFFERENCES IN THE ASSESSMENT OF EHEALTH PORTALS AND MHEALTH APPLICATIONS IN STUDENTS' PERSPECTIVE

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Purpose: The aim of the article is to identify students' views on the possibilities of using modern information technology tools in prevention and health protection at the University of Economics in Katowice, divided into distinguished fields of study.
Design/methodology/approach: The main research tool was an electronically distributed survey questionnaire (Computer-Assisted Web Interview). The research was conducted in mid-2023. The obtained results were reduced to comparability by counting percentages in individual answers to questions. To analyze the differences between fields of study, urban and Euclidean distances were calculated. Additionally, hypothesis H_1 was put forward about a statistically significant differentiation of the obtained answers. The measure was the right-sided F-Snedecor test.
Findings: The presented results are part of the research on knowledge and awareness and the use of modern IT tools to improve the living conditions of society. Obtained results identify students' views on the use of portals and mobile applications (mHealth) in the field of eHealth, while the hypothesis about significant differentiation was verified only in 9% of cases.
Research limitations/implications: The limitation of this study was that it was based only on a single university and young people from the academic environment. Nevertheless, the conclusions presented may help shape the policy of building and using portals and Internet applications in prevention and health protection by students – potential, future IT specialists, and companies involved in their construction and modification at present.
Originality/value: The uniqueness of this study lies in its focus on the analysis of the views of a specific group of end users on the possibilities of using IT tools across the fields of study, at the distinguished university.
Keywords: prevention and health protection, information technology in health protection, awareness of the possibilities of using IT in health protection, differences in opinions about eHealth by field of study.
Category of the paper: Research paper.

1. Introduction

The issue of broadly understood health protection, including the promotion of a healthy lifestyle and planning its protection after the COVID-19 pandemic, has become particularly important in the social, economic, and – as it turned out – also technological policies of the governments of individual countries (Omari et al., 2021). Particularly dynamic growth, due to the imposed restrictions on movement and interpersonal contacts, occurred in the use of information technologies for this purpose. Health threats caused by the pandemic resulted in an avalanche of interest in eHealth portals and mobile applications (mHealth). Even if these needs have decreased somewhat after the end of the pandemic, due to the lack of the need to register vaccinations or remote consultations, it seems that the remaining awareness of the convenience of using most eHealth functionalities has remained. We undertook research on this topic due to the importance of the issues they concern. The scope presented in this article is fully consistent with previous comparative studies conducted for the University of Economics in Katowice and the University of Warsaw, concerning not only comparisons of general opinions expressed by students of these universities but also comparisons in regional and gender cross-sections. The current article is a detailing of previous studies (Chmielarz, Sołtysik-Piorunkiewicz, 2024) and focuses on the one hand on the identification of opinions on eHealth portals and mobile applications (eHealth) and the comparison of these opinions in the cross-section of two courses of study at the University of Economics in Katowice (informatics and management of the total of respondents from other courses).

Analysis of the impact of IT on prevention and health care is widely present in the literature (see section 2), but it mainly concerns problems related to health threats, methods of preventing these threats, methods of treatment, and, perhaps even above all, methods of communication with doctors and health care facilities (Sołtysik-Piorunkiewicz, 2018). While in the former topics, the role of IT is primarily reduced to providing competent information on individual diseases, methods of their treatment, drugs, and paramedicines; in the second field, IT offers complete procedures for searching for public and private health facilities, with a full range of possibilities for registering with the right doctor at any time, issuing prescriptions, providing advice, etc. The application of artificial intelligence (AI) or remote control of surgical operations, decision-making support in rare but recognizable clinical cases, etc. are also being analyzed more and more widely (Cameron, Ramaprasad, Syn, 2017). However, cases of examining the awareness of future patients are rare, especially young ones, i.e. those who reach for online communication rarely in their cases, more often for their loved ones or friends (Octavius, Antonio, 2021). Even rarer – for such environments that may constitute not only a potential customer base but also, from a professional point of view, become designers and/or makers of tools for on-site or remote service of this, as we have shown, social and economic field. The lack of their assessments and opinions, with recommendations, does not allow for

a reliable pre-design or pre-implementation analysis – preceding the construction and implementation of IT tools into reality. The effects of the lack of recognition of the current state are visible in the knowledge and social awareness of eHealth portals and mobile applications, sometimes too complicated for the average person. This constitutes a research gap that can be filled, together with the previous ones, by the presented studies.

Therefore, the article aims to identify and compare the views of students of informatics and management at a selected university on the possibilities of using modern information technology tools in prevention and health care. As mentioned earlier, on the one hand, they are clients of these tools, on the other – soon – they may design such systems (e.g. management students) or create them (e.g. IT students). The scope presented in this article is consistent with previous comparative studies conducted for the University of Economics in Katowice and the University of Warsaw, concerning not only comparisons of general opinions expressed by students of these universities but also comparisons in regional and gender cross-sections. An attempt was also made to make international comparisons between Poland and Turkey.

To achieve this aim, the following structure of the article was adopted. The first section introduces the subject matter of the issue, presents the research problem generally presents the state of previous research, and identifies the research gap and its goals derived from it on this basis. The next section synthetically presents the research conducted on the subject of IT in health care and, against this background, the originality of the conducted research. Then, the research procedure, research sample, and research methods are presented. The fourth section contains an in-depth analysis of the obtained results. A discussion of these results is presented in the fifth section. The last section contains conclusions summarizing the research, describing its limitations and resulting directions of future research.

2. Literature review

The World Health Organization (WHO) adopted a definition of health in its constitution, which states that: health is not only the absence of disease or disability but full physical, mental, and social well-being (Światowy Dzień Zdrowia - 7 kwietnia 2023 r., no date). The definition shows that it is also a social dimension that makes people able to maintain relationships with others. All this affects the multi-faceted perception of the issue of human health (Maszczak, 2005).

Dynamic social, economic, and technological changes make it necessary to ”manage health”, meaning providing the population with easily accessible, effective, and appropriately high-quality health care, but also prevention, promotion of a healthy lifestyle, sports, etc. This comprehensive and complex phenomenon is influenced by various factors, including profound technological changes that have allowed, among other things, to mitigate the effects

of the COVID-19 pandemic (Giansanti, 2021). The diversity of the health management phenomenon simultaneously occurs in separate areas of activity undertaken in broadly understood health care: disease prevention, pro-health behaviors, and health care planning.

Disease prevention consists of the possibility of avoiding or stopping the disease through skillful action preceding the disease state: the use of stimulants (e.g. smoking, excessive alcohol consumption, drug use, overweight and obesity, lack of physical activity, or stress). They are the cause of many diseases such as hypertension, atherosclerosis, heart attacks (Chomik, 2019), and cancer (Tokarczyk, Kloc, 2020). Health education can help reduce the impact of these phenomena, which is also widely possible via the Internet using social networking sites. The Internet also widely promotes physical activity, healthy eating, or regular monitoring of one's health through preventive examinations. Reaching the elderly is not always possible via the Internet by choosing the right doctor who, in addition to preventive examinations, will also feel the need to educate them about proper health behaviors. Screening tests are also important to detect possible irregularities and early symptoms of the disease (Aniśko et al., 2020). In this way, a quick response can be taken by visiting the appropriate specialist. Institutional restrictions are also important – a ban on buying alcohol at certain times, or a ban on the consumption of energy drinks by young people. Health-promoting behaviors are conscious choices and actions taken by individuals to support health, prevent disease, and improve their general physical and mental condition (Gruszczyńska, Bąk-Sosnowska, Plinta, 2015). They concern many areas of life, in which, after implementing appropriate actions, they will result in improving health or preventing its deterioration. The greatest impact of these phenomena is: an appropriate diet (healthy eating pyramid) (Olszak, 2018), proper working conditions, regular examinations, personal hygiene, giving up habits, etc.

Healthcare planning consists of creating a strategy for organizing and managing health or treatment in order to provide the patient with the best possible care. The most important thing here is the choice of a health facility and doctor, regular check-ups on health through preventive examinations and consulting them with your doctor, in the case of chronic diseases – treatment in accordance with the doctor, i.e. regular taking of medications and monitoring health status by monitoring test results. Unfortunately, many patients forget about the regularity of these activities, hence the emergence of more and more portals and mobile applications on the market that remind patients of the mandatory taking of medications or the next recommended dates of visits for tests. You can also consider using an appropriate device, such as a smartphone or smartwatch, which will regularly measure specific parameters of our health in everyday life to best control the disease (Bogusławski, Czech, 2019). The above actions allow you to partially prevent such challenges as reducing the cases of people affected by chronic diseases. Data from WHO show the scale of the problem presented above. WHO analysis indicates that 74% of all deaths in the world are caused by chronic diseases of the circulatory system and respiratory system, diabetes, strokes, or cancer (Noncommunicable diseases, 2023). Therefore, such a significant challenge in the current times is to pay special attention to stopping the

development of the number of these cases through innovative preventive and technological programs and science on their prevention (Topór-Mądry, 2011).

The second challenge is the aging of society. The increase in life expectancy does not go hand in hand with the expected number of years of healthy life (Jeziorska, 2017). For this reason, in the long term, the demand for healthcare specialized in geriatrics and for funds for the implementation of healthcare programs will increase. Currently, about 40% of first aid cases provided by paramedics are for people over 65 years of age, and due to changes in the demographic structure, this number is expected to increase.

The third challenge is the uneven access to health services, caused by location difficulties (rural residence) (Ucieklak-Jeż, Bem, 2017) or access to specialist services (shortage of doctors or economic resources for private treatment) (Genowska et al., 2015). It seems that the development of telemedicine can remedy this. Telemedicine allows for medical consultations at a distance, eliminating the need to physically go to a medical facility. The advantages of telemedicine were appreciated during the COVID-19 pandemic (Dobska, 2021). However, the implementation of telemedicine requires appropriate infrastructural and educational support.

ICT is one of the most important elements in health management. It increases the quality of medical care, increases the effectiveness of prevention and health protection systems, and improves the management of medical information (information on medicines and treatment methods). The basic technological tools supporting these processes are IT systems, Internet portals, and mobile systems in mHealth based on smartphones and smartwatches (Sołtysik-Piorunkiewicz, Furmankiewicz, Ziuziański, 2015). Moreover, in addition to the phenomenon of mobility (Akter, D'Ambra, Ray, 2013) and telemedicine systems (including telemonitoring systems), artificial intelligence systems are increasingly used (Bień, 2022).

To put it simply, IT systems in healthcare have functionalities responsible for specific functions (Sołtysik-Piorunkiewicz, Furmankiewicz, Ziuziański, 2019). These include patient registration, medical documentation management, health monitoring, and support for diagnosis and treatment planning. In this way, facilities are able to improve the transfer of information and improve the quality of healthcare (Winter et al., 2023).

The second such tool is electronic patient records and electronic medical records. They enable effective management of patients' medical data by collecting, storing, and sharing information about patients' health in electronic form. Electronic patient records are a set of health data relating to a specific patient admitted to a given healthcare facility. With the advent of the Internet, there has been an increase in the use of electronic systems that allow easier access to a patient's medical history (Winter et al., 2023). Unfortunately, some systems, especially in private facilities, still do not share test results with other entities, even public ones.

Artificial intelligence (AI) is defined as the simulation of human cognitive processes, including pattern recognition, learning, data analysis, and then making decisions based on them (Kaplan, 2019). Thanks to these properties, AI has allowed for better disease diagnosis, therapy

planning, and monitoring of the patient's condition (Furmankiewicz, Sołtysik-Piorunkiewicz, Ziuziański, 2014). Examples of AI applications in specialist medicine include fields such as dermatology, cardiology, ophthalmology, and radiology. AI has therefore become a helpful tool for detecting cancer. Artificial intelligence is increasingly able to meet these requirements (Patrzyk, Woźniacka, 2022).

Chatbots can also play a positive role. They can help in diagnosing symptoms, providing nutritional recommendations, e.g. in psychiatry. Studies indicate that patients with depression, anxiety disorders, or schizophrenia show great satisfaction from using this type of tool (Patrzyk, Woźniacka, 2022). Although chatbots still face many challenges in interpreting human language, they have great potential.

In the literature, telemedicine is also present after the COVID-19 pandemic. Telemedicine consists of replacing a traditional visit to a doctor with a telephone consultation or a visit on a camera using a computer or smartphone, which we can do from anywhere, e.g. from home (Zdrojewicz, Głód, Dołowiec, 2014). Currently, this method of contact with a doctor has become popular to a limited extent, because, among other things, it allows access to professional health care regardless of place of residence.

Patient notification systems are also important for the development of telemedicine, as they automatically inform about appointment dates or the possibility of canceling them through reminders sent by text message, e-mail, or using a mobile application (Giemza, Janowski, Jóźwiak, 2017). Currently, it is also possible to send reminders to take medication through applications on the phone or wearable monitoring devices (i.e. VisiMed – Kamsoft). This application, among other things, sends notifications about the need to take medication (Nacinovich, 2011).

Online healthcare platforms are a key element of eHealth systems, which allow patients to manage their health by monitoring their health condition and controlling the treatment process. The platforms use the Internet and mobile technologies (Furmankiewicz, Sołtysik-Piorunkiewicz, Ziuziański, 2016). In this way, patients have access to their medical data, test results, and medical recommendations on their mobile devices for mHealth (Duplaga, 2010). An additional advantage is the possibility of issuing an e-prescription without having to visit the office. Thanks to these facilities, patients are much more involved in the treatment process and it ensures much greater safety in conducting therapy.

The use of these solutions brings benefits not only to patients but also to the entire healthcare system. This allows for a reduction in treatment costs and a reduction in the need for hospitalization of people with chronic diseases.

The above literature review shows that the subject of computer applications in prevention and health care is very broad and includes, on the one hand, the characteristics of the premises of computerization, its potential benefits, directions and tools, as well as certain specific limitations. There is little literature on the opinions and assessments of eHealth tool users in the

field of analysis and assessment of portals and mobile applications. This is a research gap that this article hopes to fill.

The main goal of this article is to identify students' views on the possibilities of using eHealth portals and mobile applications from the point of view of their potential users from the UE in Katowice. Additionally, these opinions were examined in terms of similarities and differences between students of informatics and management (other) analyzed fields of study at this University.

To achieve this goal, the following research questions (RQ) were asked:

- RQ1: What infrastructural conditions are met to ensure access to eHealth?
- RQ2: What is the knowledge and awareness of eHealth users about portals and mobile applications?

This article answers the proposed research questions.

3. Methods

3.1. Characteristics of the research sample

In mid-2023 a survey was conducted at the University of Economics in Katowice on the opinions of students regarding the use of portals and mobile devices in the field of eHealth. The study covered three fields of study: computer science, management, and informatics and econometrics. In total, out of 290 people, 215 people correctly completed the survey questionnaires, which is 74% of the respondents. Due to the similarities and differences in the programs of the respondents from these three fields, it was decided to combine the survey results into two groups: informatics (64%) and management (36%).

On average, 42% of women and 58% of men participated in the survey and provided full answers, with an uneven distribution: in the informatics department – 28% of women and 72% of men, and in management – 65% of women and 35% of men.

Due to the location of the study (higher education), an average of 84% of respondents were aged 19-24 (9% more in management). In second place was a group of 14% of people aged 25-34 (10% more in computer science). People outside the 19-34 age group were a marginal number. The random selection of groups meant that an average of 20% of people taking part in the survey had secondary education at that time, and 13% had a bachelor's degree. Incomplete higher education was on average 5%, and higher education 4%. High absolute differences of 24% occurred at the bachelor's level (with a predominance for management – which means that the survey was conducted mainly at the master's level) and secondary education of 14% (with a predominance of respondents from the field of computer science).

The majority of respondents (33%) come from cities with 51-200 thousand inhabitants and slightly fewer (26%) from cities with more than 200 thousand inhabitants. Together, this gives a 59% share of the entire surveyed population. In the field of computer science, in the latter case, there were almost 8% more respondents than in management. On average, 18% of respondents come from rural areas, with 11% more studying management, outside of computer science. 10-12% of respondents come from cities with less than 20 thousand inhabitants to 50 thousand inhabitants.

The financial situation of the surveyed students is generally (on average 53%) good (as stated by 8% more students of computer science) or very good (on average 17%), which constitutes 70% of the population. Sufficient and poor financial situation concerns only less than 3%, and the average is 16% of students. Some of them (11%) declared a lack of financial independence (student supported by parents).

3.2. Research procedure

The following research procedure was adopted to achieve the assumed goals:

- literature analysis of the subject matter in question in terms of opinions and evaluation of internet portals and mobile applications used in eHealth by students,
- setting the research goals and research questions,
- selecting the research tool (survey questionnaire) and the method of conducting the study (CAWI – Computer-Assisted Web Interview),
- based on the research conducted in this area, the adaptation of the survey questionnaire,
- conducting the research and analysis and discussion of the results,
- drawing conclusions and recommendations.

The survey questionnaire we adapted (Chmielarz, Sołtysik-Piorunkiewicz, 2024) contained five sections, three of them was adopted for this study.

1. Infrastructure of the respondents' operation on the Internet:
   - devices for communication with the Internet used by the respondents,
   - software for contact with the Internet used by the respondent,
   - purposes of using the Internet divided into private and business,
   - frequency of using the Internet,
2. Knowledge of the respondents about eHealth portals and mobile applications:
   - interest of the respondent in health protection via the Internet,
   - acceptance of IT in medical services,
   - sources of information on supporting health protection via the Internet,
   - frequency of using eHealth portals,
   - improving the patient-doctor relationship with the help of eHealth portals,

3. Awareness of innovation in prevention and health protection:
   - mobile solutions,
   - applications in the field of artificial intelligence,
   - telemonitoring and/or telecare.

Data obtained from the survey forms were reduced to comparability by calculating the participation coefficients in individual fields of study, and then a reliability analysis was applied in the form of calculating the Cronbach's α coefficient. For all specified evaluation criteria, Cronbach's α was greater than 0.7, which indicates the internal consistency and reliability of the sample.

This was the initial stage of the entire study. After calculating the structure of the answers, the arithmetic mean, variance, and standard deviation were calculated for each question/ attribute. Then, the absolute distance between individual categories in individual questions/ attributes (city distance) and the Euclidean distance was calculated.

In addition, the research hypothesis H_1 was put forward about a significant differentiation of opinions of students of informatics and management. To determine the statistical significance of the differentiation in individual questions/attributes, the right-sided Fisher-Snedecor test was used. When the calculated value of the test exceeded the tabulated value for a given number of degrees of freedom, a significant difference was concluded. To prove the truth of this hypothesis, the α significance level was calculated for the right-sided F-Snedecor distribution. The F-Snedecor test was used here to compare the degree of significance of two data series and the p-value determined based on the test values (i.e. compare the test results of the $FS_{calculated}$ test value with the tabulated $FS_{tabulated}$ value). If $p \leq \alpha$, we reject the hypothesis, and if $p \geq \alpha$, we accept the hypothesis.

4. Results

4.1. Research infrastructure

The remaining directions were blocked due to the very uneven distribution of correct answers to the survey. The structure is presented in Table 1.

Table 1.
Structure of responses to the survey according to the analyzed directions

Analyzed majors	Percentage share
Computer science	64.32%
Management	18.78%
Informatics and econometrics	16.90%
Total	100.00%

Source: own study.

Respondents use devices to communicate with the Internet in a variety of ways. On average, they most often (66%) used a combination of a smartphone and a laptop or other devices and their combinations 13%. In third place was the combination of a smartphone and another device (12%). The smartphone itself was only in the next position (6%), and using only a laptop is a marginal use. The greatest difference between the uses of devices (city distance – 19%) occurred between the group of respondents from both fields of study using smartphones and laptops in parallel. In the field of computer science, 59% of students use this combination, and in management 78%. In the combination of a smartphone and other devices, this difference exceeds 8%, with a 15% advantage in the number of uses in the field of computer science. It is similar in the scope of the use of other devices or their combinations – the absolute difference is 5%, with a 15% advantage in the use of these devices in the field of computer science. Similar differences in relative terms are presented by the Euclidean distance (Table 2). The F-Snedecor test of data series diversity is 1.9524 and does not exceed the critical value.

Table 2.
City and Euclidean differences in opinions on the use of devices for communicating with the Internet in selected fields of study

Row Labels	City distance	Euclidean distance
Smartphone and Laptop	18.51%	3.43%
Other Device or Combinations	5.39%	0.29%
Smartphone and Other Device	8.02%	0.64%
Smartphone	1.31%	0.02%
Laptop and Other Device	2.33%	0.05%
Laptop	1.46%	0.02%
Grand Total	0.00%	0.00%
Variance	0.43%	0.02%
Standard Deviation	6.58%	1.34%

Source: own study.

Students of the analyzed fields of study mainly use mobile applications and/or Internet services to communicate with the Internet. Only 13% of students use the mobile application itself on average, and only 10% use the Internet service. The above significant differences in applications mean that the variance (9%) and standard deviation of 31% are relatively high. On the other hand, the differences in the urban and Euclidean distance between the informatics field of study and management in individual options are relatively small and reach values of only 1.4% at most. For this reason, the value of the F-Snedecor test is low and amounts to 1.0146.

The next question concerned the use of mainly specialist services, social services, or mobile applications when using the Internet in everyday life. The vast majority (69%) answered on average that they use mobile applications for this purpose, and most of the remaining people (30%) had no opinion on the matter. The use of the remaining options was marginal, not exceeding one percent. Similarly to the previous case, the variance was high (on average 10%), as was the standard deviation (on average 32%). The largest difference occurred in the

option ”*I don't know*” – 13% with a predominance for management, a difference of 11% in the option mobile application, with a predominance of the informatics major.

The vast majority (on average 91%) of surveyed students contact Internet resources several times a day, mainly using a smartphone and laptop. A small number of 4% declared its use from time to time and 2% several times a week. The very uneven distribution of answers (one mode) resulted in a high value of variance and standard deviation. The differences between respondents of individual majors did not exceed 4.5%.

4.2. Knowledge of respondents on eHealth portals and mobile applications

The situation was completely different in the case of the assessment of respondents' interests in prevention and health protection supported by Internet portals and mobile applications. On average, 42% of respondents stated that they were *...moderately interested…* in this topic, and 29% on the contrary *...yes, they have always been interested….* On average, almost 8% were not interested at all. However, the distribution of answers that made up this average is quite different – 59% of respondents expressed average interest in management in the UE, 24% in IT. On the other hand, 31% of respondents expressed high interest (*yes, I have always been interested*) in IT, 27% in management. An even greater difference occurred in the category *...a little bit, yes…* – 26% expressed such an opinion in IT, and only 8% in management. This is where the large absolute (city distance) and Euclidean differences came from. In the case of the category *...I am moderately interested in…* they amounted to city distance 35% (and 13% respectively), in the case of the category *...a little bit like that…* 17%. Since the distribution in the individual categories was similar and more even than before, the variance (average 3%) and standard deviation (17%) were not too high. However, the differences between the assessment of the categories in the two analyzed data sets resulted in statistically significant differences between them expressed by the F-Snedecor test ($FS_{calculated} = 3.8754 > FS_{tabulated} = 2.6030$).

Familiarity with the concept of eHealth defined by categories (*yes, I heard, I think I heard, someone told me about it, I haven't heard, I don't know*) focused around the concept *...yes, I heard…* on average 40% and *...it seems to me that yes…* 29%, which together gives significantly more than half of the answers (69%). Significant absolute differences (16%) occurred in the category of *...I have not heard…*, where as many as 28% of students from the IT field of study claimed that they had never heard of eHealth portals and applications, and *...I have heard…* (8%), with a predominance of opinions from management students. The variance and standard deviation were small, the calculated value of the Snedecor F test did not exceed the tabulated value. Interestingly, the acceptance of the use of IT to support medical services among the respondents is much more ”optimistic” than their knowledge of eHealth portals and mobile applications. On average, the options *...rather yes…* (45%) and *...yes, fully…* (44%), are 89% of the entire surveyed population, definitely in favor of acceptance. The differences in the statements in the surveyed fields of study do not exceed 10%

(...*on average*..., the predominance of opinions from management) and slightly less than 9% (in the category ...*yes, fully*..., with a predominance of respondents from the IT field of study). The variance and standard deviation are low, as is the F-Snedecor test. Since the previous questions showed partial unfamiliarity with the concept of eHealth, according to the respondents, knowledge on this subject should be sought primarily on the Internet, on healthcare portals of private medical companies and their associations (on average 36%) and (23%) on government healthcare portals (e.g. e-Zdrowie, IKP – Indywidualne Konto Pacjenta). Mobile applications (e.g. mObywatel/eRecepta and mObywatel/Uniowy Certyfikat COVID) were only in third place (12%). Social media institutions dealing with healthcare (e.g. Centrum e-Zdrowia) were only in subsequent places. Such sources of information as daily and specialist press, TV programs and films, colleagues and friends, healthcare associations, and literature/newsletters/leaflets on eHealth were almost completely ignored. Differences not exceeding 5% were observed in the category of social media (5%), with a predominance of opinions of respondents in management and Literature/newsletters/leaflets on eHealth (4%), with a predominance of opinions in the field of computer science. Variance statistics and standard deviation do not show high differentiation, and the F-Snedecor test does not take on a value higher than the tabulated ones.

The lack of knowledge about eHealth portals and mobile applications means that only slightly over a quarter (26%) of respondents have a high level of awareness of the possibilities of assistance in obtaining medical services electronically. The majority (average 38%; Informatics 41%, the remaining 36%) are rather in favor of an average level of awareness in this area or have no opinion on the subject (average 18%). In the latter category, students of other studies (22%) show a 9% greater ignorance. Slightly less differentiation (5%) occurred in the average awareness of eHealth services. The variance (2% and standard deviation (14%) are low, the F-Snedecor test does not exceed the limit values.

In view of the above results, the opinions contained in the answers to the next question of the survey should not be surprising. The respondents, e.g. due to age or good health, had too little contact with portals and mobile applications to be aware of their full capabilities. contact only when necessary is admitted by an average of 48% of respondents (similarly in both analysed fields of study) and 22% from time to time (23% in IT and 20% in management). Around 9-10% have never used eHealth portals and applications and on average 9% less often than once a month. In this last category, there is the largest 8% differentiation of opinions, with the majority of respondents from other fields of study. In this case, the F-Snedecor test has a value lower than tabulated. In the process of prevention, treatment, and rehabilitation, the patient's relationship with the doctor is important. This problem was presented in the form of a question about the impact of eHealth solutions on improving these relationships. Over 46% of respondents believe that it is possible (to a very high and high degree). However, on average 37% of respondents believe that it can only be achieved to a medium degree, and 8% to a low or very low degree, which almost balances out the positive opinions. The variation in opinions

is very small, the largest (5%, with a predominance of opinions on management) occurs in the category of low degree of improvement of relations and 3% in the category of very high degree of relations. All statistics are at a low level.

4.3. Awareness of innovation in prevention and healthcare

The next section of the survey examined respondents' knowledge of the applications of the latest trends in ICT development in prevention and health care: mobile solutions, artificial intelligence, telemonitoring, and/or telecare. The opinions obtained were compared with the results of research conducted on 11.5 thousand healthcare facilities by the eHealth Center and the Ministry of Health (*VI Edycja „Badania stopnia informatyzacji podmiotów wykonujących działalność leczniczą"*, 2022). This study found that almost 26% of the surveyed facilities indicated the use of telemedicine solutions as part of their activities. Another 13% of the surveyed organizations admitted that they were not currently using such solutions, but were planning to implement them within a year. Among the telemedicine solutions (53% on average), teleconsultations/teleconsultations were most frequently mentioned (98%), much less often telemonitoring/telecare (8%). Only 4.5% of the surveyed facilities use mobile solutions. Among them, the most use remote consultations with a specialist (61%) and remote clinics, i.e. a care system based on telemedicine services and electronic medical records (28%). Tools supported by artificial intelligence are used by 10.2% of facilities, including most often – hospitals (6.6%), then Outpatient Health Services facilities (2.3%) and other facilities (1.3%). In all types of facilities, these are most often solutions used in imaging diagnostics such as CT (computed tomography) and in imaging diagnostics such as MRI (resonance imaging). Computed tomography is used in particular by entities other than hospitals (75.0%), while resonance imaging was slightly more often indicated by hospitals (25.5%). Knowledge of mobile applications in the field of electronic prevention and health protection among respondents was similar in both fields of study analyzed. In the first area – prevention – it was underestimated (a share of 10% and 20%, assessed at only an average of 8%) or overestimated (a share of 2.5% resulting from previous studies, assessed at 4%). In the area of application of mobile solutions in healthcare, their average share was assessed at 2% (with their actual share of 5%). There were no significant differences in the opinions of both analyzed directions.

In the area of application of artificial intelligence in healthcare facilities, the most common (almost 40%) was an average of 2.5%, while the value from the cited studies indicated that AI elements covered a total of 10% of facilities. Only 12% of respondents indicated such a percentage of the number of facilities. On the other hand, one fifth of respondents (21%) claimed that artificial intelligence is not used in healthcare organizations at all. The absolute differences were not high – they did not exceed 5%.

In the area of telemonitoring or telecare, over 50% indicated the existence of such solutions in 2.5-5% of medical facilities. In reality, the average result was 53%, which was mainly due to teleconsultations. If only telemonitoring/telecare were taken into account, the final result

would be close to 10%, and only 15% of respondents indicated such a share. In the latter case, there was a statistically significant difference in opinions between the respondents' assessments from both analyzed directions, expressed by the results of the F-Snedecor test ($FS_{calculated} = 3.1893 > FS_{tabulated} = 2.6030$).

5. Discussion

The analysis of the first group of results indicates the strategy of using IT resources for communication with the Internet. This is a mixed strategy consisting in the simultaneous use of a laptop and a smartphone. This is of course in a way forced by the specificity of the studies undertaken, as well as, on the other hand, the individual and private needs of students. It seems understandable that in the field of computer science, using smartphones to support the course of study has its significant limitations resulting from specialist, strictly IT subjects. In the field of management, the use of smartphones concerning laptops has its logical justification. The answers to the first question somehow determine the answers to the second one in advance – the use of portals and mobile applications at the same time – this is a situational requirement caused by the course of study. Rather – except for emergencies, you cannot afford to use only mobile applications here. Mobile applications (mHealth) are commonly used by respondents to communicate with social media. Students are a group of very active Internet users, over 90% contact it several times a day. This was a good prognosis as to their ability to evaluate eHealth portals and mobile applications.

High interest in the Internet, its very frequent use and use both to support learning and for private purposes does not translate into interest in eHealth portals and mobile applications. If 50% of respondents declare that they are moderately or not at all interested in this topic, then of course the conclusion is that these are young people, in good health and physical condition, far from thinking about their own and their loved ones' health. On the other hand, it would seem that eHealth portals and mobile applications should be of interest to them, they are among the most important from the point of view of the aging society, and for them as current/future professionals should be a lucrative field of future work. And indeed – there was a huge difference between IT students and management students in many of the analyzed categories. There is a lack of knowledge in practical studies in IT implementation and project implementation in eHealth and mHealth, esp. in the context of AI tools usage and mobile applications development. This caused the F-Snedecor test to exceed the threshold tabulated value in this case and indicated a statistically significant differentiation of responses in both analyzed fields of study. Interestingly, almost 70% of students have heard of eHealth portals and mobile applications. How can you not be interested in them? What is even more remarkable is the level of acceptance of the existence of such tools and the possibilities of using them is

consistently high – the answers that they fully accept and rather accept were given by almost 90% of respondents! If the respondents admitted their deep ignorance at first, where should they get information on the subject? The respondents stated that they primarily find it on the Internet on portals concerning private medical companies and their associations and on government portals. Only then in mobile applications, and social media came in further places. The lack of knowledge about eHealth also has its consequences in the awareness of the possibility of obtaining help through eHealth portals and mobile applications – only a quarter of respondents are aware of this. The lack of this awareness has its second consequence – only 48% of respondents contacted eHealth tools in emergency cases. The answers in both directions are not diverse – the global village phenomenon causes a shallowing and limitation of the range of views, especially among generation Z, and this generation also includes current students. Only non-standard questions, e.g. about the possibility of improving the relationship with a doctor through portals and mobile applications, quantify the answers – in this case, 46% believe that it is possible to a high degree, while 37% believe that it is only possible to a medium degree.

Knowledge about modern solutions in eHealth portals and mobile applications (mHealth) was similar. To sum up the answers to the questions about the percentage of mobile solutions, artificial intelligence, and teleconsultations/telemonitoring used among healthcare facilities, the respondents' knowledge about the applications of modern ICT solutions in telemedicine is fragmentary, small, and incomplete. This may be because the answers to the survey were provided mainly by young people, students, healthy and in full strength, not yet attaching too much importance to their condition and health, as well as problems with maintaining health or restoring it.

6. Summary

The main objectives of this article have been met because:

- the basic technological infrastructure used by students of selected courses at the University of Economics in Katowice in their contacts with the Internet was identified, in terms of hardware, software, frequency and goals of activity,
- the degree of their knowledge of eHealth portals and mobile applications was determined in terms of the source of knowledge, interest in and acceptance of health care via the Internet, the frequency of using eHealth, and their awareness of modern IT solutions in healthcare was checked.

Then, the results were discussed and assessed, drawing attention to the inconsistencies between the awareness and knowledge of this industry among students, while at the same time wanting and fully understanding the need to use them in everyday life. Their level of education

also helped to determine what is missing in the current electronic healthcare system, and in particular in portals and mobile applications.

However, hypothesis H_1 about significant statistical differentiation of the opinions of students of Informatics and the other analyzed fields of study was not verified. Out of twenty-two analyzed options, only two of them had an advantage of the F-Snedecor test calculated over the tabulated one, which constitutes 9% of all results.

The conducted research had two basic limitations. The first was the significant advantage of the number of surveyed students from the informatics field of study over students from the management field of study. Of course, it was permissible to gather management informatics and econometrics fields of study in one group and compare them with students of computer science, but perhaps better results could be obtained by extending the survey to all fields of study gathered under the name of management. The second limitation was the small sample size and the fact that it concerned only and exclusively students of the University of Economics in Katowice. It seems that the panacea for these ills would be the above-mentioned extension of the distribution of surveys in the EU management course in Katowice and conducting a similar study in other universities of this type in Poland in similar or the same faculties/courses. Further studies should follow such comparative analyses.

Our findings indicate possible further directions of research development toward including all university employees and foreign universities, increasing the number of analysed scientists. We also believe that this research can constitute the basis for constructing and verifying a model of eHealth adaptation to modern information technologies and their acceptance by users. This is a promising research direction, but it would require reformatting the survey questionnaire and adapting it to the requirements of the technology acceptance models, i.e. TAM, or UTAUT, and acceptance theories with the unified theory of acceptance and use of mobile technology models, i.e. UTAUT2. eHealth education into curricula would be helpful for the overall usefulness of knowledge and innovation of ICT in healthcare.

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