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USE OF WEB 2.0 TOOLS BY POLISH HEALTH PORTALS

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Abstract. *The Internet, as a global, universal communication network, has become an important channel of information distribution. Currently, it has a very social character, thanks to the dissemination of Web 2.0 sites, which allow users to create and publish their own multimedia content. Web 2.0 technologies make it easier for users to communicate, create, collaborate and share information. They are widely available and are characterized by low costs of use. The article presents the results of research on the most popular Polish health websites. It was examined whether health services meet the requirements of Web 2.0 sites. The analysis is focused on the technological and social aspects. The COVID-19 pandemic lockdown in March and April 2020 in Poland was observed as having an influence on users and views of heath websites. The obtained results confirm the use of elements (both technological and social) by health services selected for research. However the usage of Web 2.0 technologies among websites varies.*

Keywords: health information, health websites, Web 2.0, Health 2.0

WYKORZYSTANIE NARZĘDZI WEB 2.0 PRZEZ POLSKIE PORTALE POŚWIĘCONE ZDROWIU

Streszczenie. *Internet, jako globalna, uniwersalna sieć komunikacyjna, stał się ważnym kanałem dystrybucji informacji. Obecnie ma bardzo społeczny charakter, dzięki upowszechnieniu serwisów Web 2.0, które umożliwiają użytkownikom tworzenie i publikowanie własnych treści multimedialnych. Technologie Web 2.0 ułatwiają użytkownikom komunikację, tworzenie, współpracę i udostępnianie informacji. Są powszechnie dostępne i charakteryzują się niskimi kosztami użytkowania. W artykule przedstawiono wyniki badań najpopularniejszych polskich serwisów poświęconych zdrowiu. Zbadano, czy usługi zdrowotne spełniają wymagania witryn Web 2.0. Analiza koncentruje się na aspektach technologicznych i społecznych. Zaobserwowano, że zamknięcie gospodarki wskutek pandemii COVID-19 w marcu i kwietniu 2020 r. w Polsce znacząco wpłynęło na użytkowników i oglądalność witryn o tematyce zdrowotnej. Uzyskane wyniki potwierdzają wykorzystanie wybranych do badań elementów (zarówno technologicznych, jak i społecznych). Jednak wykorzystanie technologii Web 2.0 na poszczególnych witrynach internetowych jest zróżnicowane.*

Słowa kluczowe: informacja zdrowotna, strony internetowe poświęcone zdrowiu, Web 2.0, Health 2.0

Introduction

The popularity of the Internet has increased at a galloping rate in recent years. It is present in all areas of human life and activity. It is displacing traditional media such as television, radio and newspapers. According to the annual "Digital In 2020" report of the We Are Social website, regarding the use of the Internet, mobile devices and social media, there are currently 4.54 billion Internet users around the world, 5.19 billion mobile phone users and 3.8 billion active social media users (as of January 2020) [18].

The most dynamically developing group are users of social media – their number increased within one year (from January 2019) by 9.2% (by 321 million people). The second area of significant growth was recorded in the group of Internet users (by 7%, or 298 million people) [18]. Such growth trends in the world have been occurring for several years. According to these global trends, the number of Internet users is also systematically increasing in Poland. In 2019, in Poland, 78.3% of people aged 16–74 regularly (at least once a week) used the Internet (as compared to 72.7% in 2017). About 49% of people aged 16–74 used social networking sites, that is, 65.9% of all Internet users, and 54.3% of those aged 16–74 used mobile devices [8].

The Internet is increasingly used in the area of health issues. According to Statistics Poland (pol. GUS) data, in 2017, 47.4% of Poles aged 16–74 search the Internet for health information (during the year, this rate increased by 2.4 percentage points – in 2018 it was 45%) [7]. Patients are also increasingly active on health-related blogs and Internet forums. The Internet has also become a platform for the exchange of information between patients and medical staff, and for the latter, it is also a source of professional knowledge. In general, any manifestation of the use of the Internet or ICT in healthcare is called e-health.

E-health is a broad concept that goes beyond just using information. Newer applications (so-called Health 2.0 applications) offer all types of interactive technologies that help people communicate on health issues. Internet users communicate with other patients and health care professionals, e.g. through forums or e-consultations, to independently monitor their health (e.g. through patient portals) and even obtain assistance via the Internet [17].

1. Web 2.0 technologies

E-health activities were strengthened by Web 2.0 services that appeared at the beginning of the 21st century. The Internet has become more social, giving users the opportunity to create and publish their own multimedia content. Web 2.0 is not a new information technology, but is a different way of creating websites, giving users autonomy in co-creating content on the web. Web 2.0 technologies emphasise interactivity, allow you to create groups and networks of friends, post information on the web, search it and evaluate it. These technologies are focused on the involvement of participants in creating the content of websites [13].

Formerly, websites were created by one person (author), who was the only one able to change their content. Web 2.0 focuses on users who cease to be passive recipients of the media – they can comment, add, delete, share knowledge and resources, and give their opinions on the content [11].

On the one hand, these technologies result in socializing in communication and creating content and knowledge, while on the other hand, it causes a huge increase in information and the need to support the user in the search for and access to good quality information.

Web 2.0 technologies have a social and technological dimension. The technological dimension involves the use of specific technologies, the Wiki mechanism, weblogs, providing XML interfaces that allow other websites and programs to use Web 2.0 data (mainly by ATOM and RSS).

The social dimension of these technologies focus on: the creation and modification of content by users, the emergence of communities associated with particular websites, the use of collective intelligence, open licenses (e.g. Creative Commons) and the use of folksonomy. The main features of Web 2.0 sites are [5, 19]:

1) Interactivity – allows the user to create content and interact with other users – possible by using tools such as: AJAX, XHTML, SOAP, XUL, RDF, Ruby on Rails (RoR);
2) Wiki – software enabling the cooperation of many users in creating web content, often without the need for authorization, with public access to editing the content of a certain website;
3) Opportunity for users to make contacts, create groups and social links;

4) Co-creation and sharing – active participation (making comments and assessments), ease of exchanging and sharing information with other users;
5) Staying in beta – websites are still in the development phase;
6) Breaking existing rules – websites give users new value, breaking methodologies that have been functioning on the market so far;
7) The choice of content and time of access to them – the user decides what information and when he/she uses it (e.g. through ATOM technologies or RSS feeds enabling aggregation of content from multiple sources in one place);
8) Speed of website creation – thanks to easy-to-use technologies and relatively low start-up costs;
9) Mortality of websites – disappearance of websites caused by a high level of market competitiveness.

E-health systems use a range of tools to search for information and gain knowledge about health. These include Web 2.0 tools, such as: Internet forums, discussion groups, blogs, specialist medical portals, health information websites, online encyclopaedias, on-line video consultations with doctors, doctors' consultations via the Internet, websites evaluating medical professionals, online pharmacies and drug price comparison websites. The development of information systems based on Web 2.0 solutions has opened new possibilities to improve the management of medical knowledge and has become the basis for building the Health 2.0 model and the concept of assessing the usability of these systems from the users' point of view [12, 20].

2. Health 2.0 – application of Web 2.0 technologies in e-health

The use of Web 2.0 technologies in e-health has led to the creation of the new concept called Health 2.0 or Medicine 2.0. It was presumed that the expected beneficial aspect of these projects would be the improvement of the quality and effectiveness of health care. Health 2.0 actively engages consumers in the health care system. Health 2.0 technologies assume that patients will actively contribute to their own care process. Along with the e-health concept and postulates of the use of ICT in the health care sector, a new type of patient has appeared – an e-patient (a person, who uses health care services using ICT regardless of whether they are healthy or ill) [12]. The concept of Health 2.0 also includes the concepts of "patient empowerment" [3] and the "smart patient" [2], characterized by active participation of the citizen in his or her health and care pathway with the interactive use of Information and Communication Technologies [1]. Health 2.0 serves to strengthen the position of the patient in the health care system and make it easier for him to be an active subject deciding his or her health choices.

Various concepts on the definition of Health 2.0 and Medicine 2.0 are presented in the literature. Some authors differentiate them (claiming that Health 2.0 is a broader concept regarding healthcare in general, whereas Medicine 2.0 focuses on the patient-medical staff relationship), some consider them as substitutional terms of the same concept [16]. The specificity of Health 2.0 is manifested in the fact that:

1) The creators of health content are the stakeholders themselves (mainly potential patients and medical staff) who create knowledge themselves, and disseminate it using tools such as blog, RSS, wikis, and discussion lists.
2) Patients are open to co-creating content. When a patient has a lack of knowledge, they ask questions, and expect support from others (this leads to sharing knowledge and experiences with others).
3) New resources of health content are created, which are based on blogs, and content aggregated in RSS readers. These resources coexist in parallel with specialist knowledge coming from scientific studies and from medical professionals. The catalogue of sources of content about health issues is broadened and entities have easier access to knowledge and information co-created by many authors.
4) Health 2.0 allows you to integrate existing online resources through the use of various sources, specialist studies, databases and thematic portals.
5) It is inseparably connected with the creation of social networking sites, which enable establishing contacts between their users, and participation (sharing and exchange of information) through activity on the website. Passive participants of the website (being only the recipients of information) obtain wide autonomy by the possibility of choosing the time and manner of using the shared content and the freedom of their evaluation and commenting.
6) It stimulates the creativity of Internet users who can appear on health portals in any way.
7) Folksonomy appears. This is the process of using digital content tags for categorization or annotation. It allows users to classify websites, pictures, documents and other forms of data so that the content may be easily categorized and located by users.

There is no doubt that the use of Web 2.0 elements on health portals extends the possibilities of using the Internet for health purposes. Thanks to the Web 2.0 components, websites dedicated to health can become an interactive, social portals that can be used in health care in its broadest sense.

3. Empirical studies

The selected elements of Web 2.0 were characterized in the paper. Their occurrence on the most popular Polish health portals was examined.

The 17 selected websites dedicated to health were analysed. The selection criterion was the popularity of websites measured by the number of users and page views in the Gemius/PBI study conducted in October 2016 [15]. The study concerned the popularity of health services on the Polish Internet. The results of this research are presented in Table 1.

Table 1. The most popular Internet health services, Source: Internet health websites. Research report Gemius/PBI, October 2016 [15]

Name of the website	Users	Views	Range among Internet users
poradnikzdrowie.pl	6,312,531	25,072,438	24.20%
abczdrowie.pl	4,629,965	18,929,211	17.75%
medonet.pl	2,598,347	7,817,034	9.96%
doz.pl	2,584,246	8,574,655	9.91%
mp.pl	2,342,430	8,808,737	8.98%
znanylekarz.pl	2,086,220	12,261,082	8.00%
wylecz.to	1,205,069	2,247,686	4.62%
infozdrowie24.pl	1,055,584	2,510,763	4.05%
medicreporters.com	751,315	1,316,326	2.88%
sluzbazdrowia.pl	699,221	2,119,371	2.68%
medbiz.pl	627,856	2,072,714	2.41%
gurbacka.pl	456,041	1,596,327	1.75%
kardiolo.pl	452,251	1,306,545	1.73%
rankinglekarzy.pl	449,722	1,372,503	1.72%
echirurgia.pl	408,579	1,450,914	1.57%
krokdozdrowia.pl	386,354	2,186,544	1.48%
forumginekologiczne.pl	370,945	1,169,285	1.42%

Table 2. The most popular Internet health services, Source: Internet health websites. Research report Gemius/PBI, April 2020 [15]

Name of the website	Users	Views	Range among Internet users
medonet.pl	10,178,220	74,802,872	36.1%
abczdrowie.pl	7,140,724	54,420,319	25.3%
poradnikzdrowie.pl	5,636,660	18,641,809	20.0%
wprost.pl – health	4,660,044	24,762,386	16.5%
mp.pl	4,309,647	19,954,174	15.3%
doz.pl	3,325,061	45,754,443	11.8%
radiozet.pl – health	3,144,023	11,244,523	11.1%
gazeta.pl – health	2,129,848	4,973,666	7.6%
znanylekarz.pl	2,028,816	8,166,511	7.2%
stronazdrowia.pl	1,712,531	5,703,310	6.1%

Table 3. The most popular Internet health services, Source: Internet health websites. Research report Gemius/PBI, September 2020 [15]

Name of the website	Users	Views	Range among Internet users
medonet.pl	7,518,176	35,406,446	27.2%
abczdrowie.pl	7,079,869	41,887,075	25.6%
poradnikzdrowie.pl	5,719,816	18,263,198	20.7%
mp.pl	3,964,794	16,614,012	14.3%
znanylekarz.pl	3,633,459	15,379,126	13.1%
pacjenci.pl	2,408,993	10,261,491	8.7%
medme.pl	2,005,145	4,420,167	7.2%
gdziepolek.pl	1,667,143	5,403,370	6.0%
radiozet.pl – health	1,425,574	3,855,354	5.2%
wprost.pl – health	1,234,259	4,429,739	4.5%

Table 4. The most popular Internet health services, in COVID-19 lockdown in Poland March 2020, Source: Internet health websites. Research report Gemius/PBI, April 2020 [15]

Name of the website	Avg. from 3 February to 1 March		Avg. from 9 March to 15 March	
	Users	Views	Users	Views
medonet.pl	3,593,083	8,763,874	7,093,586	28,028,363
wprost.pl – health,and,medicine	1,097,228	3,254,172	3,309,496	12,388,862
abczdrowie.pl	2,698,893	9,424,187	2,896,457	9,847,263
naszemiasto.pl – health and medicine	306,466	1,106,645	2,309,246	6,816,082
mp.pl	1,812,059	5,386,155	2,044,729	6,079,361
doz.pl – health and medicine	1,404,870	4189,107	1,922,292	9,155,806
poradnikzdrowie.pl	2,023,176	4,640,066	1,644,465	3,795,742
gazetawroclawska.pl – health and medicine	177,069	446,001	1,558,314	8,089,741
radiozet.pl – health and medicine	662,255	1,496,179	1,526,632	4,040,743
gazetakrakowska.pl – health and medicine	156,377	421,218	1,429,505	5,138,351

Table 5. The most popular Internet health services, year-by-year, Source: Internet health websites. Research report Gemius/PBI, April 2020 [15]

Name of the website	April 2019		April 2020	
	Users	Views	Users	Views
medonet.pl	5,524,137	16,350,263	10,178,220	74,802,872
abczdrowie.pl	6,201,037	48,322,801	7,140,724	54,420,319
poradnikzdrowie.pl	5,151,397	16,031,816	5,636,660	18,641,809
wprost.pl – health	-	-	4,660,044	24,762,386
mp.pl	3,551,511	15,444,085	4,309,647	19,954,174
doz.pl	3,574,259	15,325,441	3,325,061	45,754,443
radiozet.pl – health	1,577,524	3,252,380	3,144,023	11,244,523
gazeta.pl – health	1,974,414	4,009,987	2,129,848	4,973,666
znanylekarz.pl	2,680,444	14,166,146	2,028,816	8,166,511
stronazdrowia.pl	-	-	1,712,531	5,703,310

Table 6. The most popular Internet health services, year by year, Source: Internet health websites. Research report Gemius/PBI, September 2020 [15]

Name of the website	September 2019		September 2020	
	Users	Views	Users	Views
medonet.pl	5,297,265	17,124,102	7,518,176	35,406,446
abczdrowie.pl	4,736,841	30,584,460	7,079,869	41,887,075
poradnikzdrowie.pl	4,910,167	15,591,492	5,719,816	18,263,198
mp.pl	4,743,056	18,723,567	3,964,794	16,614,012
znanylekarz.pl	3,266,206	12,307,123	3,633,459	15,379,126
pacjenci.pl	-	-	2,408,993	10,261,491
medme.pl	2,435,998	5,332,692	2,005,145	4,420,167
gdziepolek.pl	-	-	1,667,143	5,403,370
radiozet.pl – health	680,206	2,231,309	1,425,574	3,855,354
wprost.pl – health	-	-	1,234,259	4,429,739

We can notice that there is a big change in the most popular Internet health services since October 2016 (Table 1–3). In October 2016, only the *poradnikzdrowie.pl* and *abczdrowie.pl* were popular among Internet users in Poland. In September 2020, we have three websites competing with each other, i.e.: *medonet.pl*, *abczdrowie.pl*, *poradnikzdrowie.pl*, whose range among Internet users is greater than 20%. Two others have a range of 13–14% (*mp.pl* and *znanylekarz.pl*).

An interesting situation can be observed in the period of COVID-19 lockdown in Poland (Table 3 to 6). The number of users and views of medical sites rapidly increased in April 2020. In the case of views of the top site, *medonet.pl*, this was 3 times more compared month-to-month. However one can notice that in September 2020, the number of users and views decreased in the case of the two top health websites.

3.1. Empirical research – technological aspects

The article presents the specificity of selected Web 2.0 technologies based on ready-made, functioning solutions that operate in the area of health services. As part of the technology area, the following web technologies have been searched: Wiki, blogs, RSS, ATOM, Ajax, and Ruby. In the social area, whether the websites offer such functionalities as a forum and newsletter was examined, and whether the websites are available on Facebook, Twitter, Google+ and Instagram. The emergence of these technologies was analysed with the help of online tools BuiltWith (https://builtwith.com/) and W3Techs – World Wide Web Technology Surveys (https://w3techs.com/), and with the Wappalyzer plugin [6].

One of the Web 2.0 technologies is Wiki technology. Pages created using this technology allow users to quickly add and modify content contained in the web browser. Wiki pages are linked by URL addresses that allow quick navigation [14]. The most popular example of these is Wikipedia – a multilingual online encyclopaedia. A Wiki is a good platform for exchanging information and materials, creating and storing them, as well as for group discussions on selected topics. It allows multiple users to work together. It allows users to document the results of their work and comment on and evaluate the work of others. It can thus broaden and enrich access to information resources, including those related to health.

The use of a Wiki in e-health may also have negative effects. Without control over the quality of content added by different users, it is not possible to verify the information. Promoting false, bad or incomplete information on the Internet can have fatal consequences for the health and lives of patients. The obtained research results confirmed that there were no Wiki technologies in use on the analysed websites.

The next Web 2.0 technology is RSS (RDF Site Summary). Thanks to RSS, websites that often update their content, publish them in an easy way, informing users about it. RSS has become an important contents distribution channel for blogs. It is the most popular standard of the so-called web feed, that is, a data format used to inform and deliver contents to users. RSS enables aggregation of content from multiple sources in one place. It gives us the opportunity to check from one place, what's new that has been published on our favourite websites and blogs.

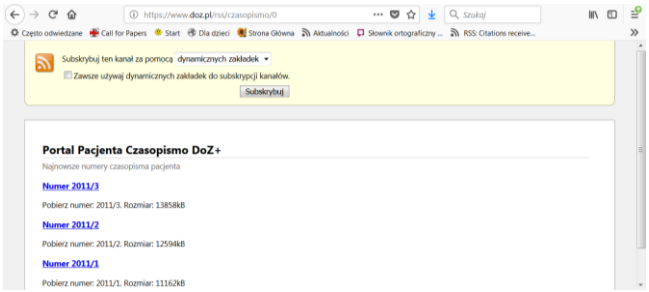

Fig. 1. RSS feeds – access to subscribed messages

ATOM is a more modern protocol than RSS. It is the standard of information channels, and was designed to replace RSS. It was created in response to problems related to the existence of parallel RSS standards (Really Simple Syndication / Rich Site Summary and RDF Site Summary) and errors of these specifications. ATOM avoids ambiguity in RSS specifications, improves compliance with XML and other standards, and adds elements that were missing from RSS.

Among the examined websites, two had an RSS feed – *doz.pl* and *gurbacka.pl* – while ATOM wasn't found on any of them. Figure 1 shows the RSS channel at *www.doz.pl*.

Another Web 2.0 tool is blogs. A blog is a kind of website, where the author places content dated in chronological order from the newest. It is a constantly updated electronic publication online. It is a kind of Internet diary, it has a very personal character, it presents the subjective assessments, comments, thoughts etc.

of the author. It can also be used as a portal dedicated to a specific topic, marketing or e-learning tool. Blogs can be run by individual authors, informal or formal groups of people, companies and institutions, authorities, local governments, and non-governmental organizations. They can be closed (intended for a specific group of readers) and open (public and available to all). On the Internet, due to the great interest in health issues, there is a large number of blogs thematically related to health care, which are run by private individuals dealing with health issues professionally (doctors, midwives, dieticians, etc.) and those for whom the health problem is just a subject of interest (hobby). In the group of analysed health services, only one (*www.znanylekarz.pl*) offered functionality in the form of blogs (separately for patients and doctors) (Figure 2).

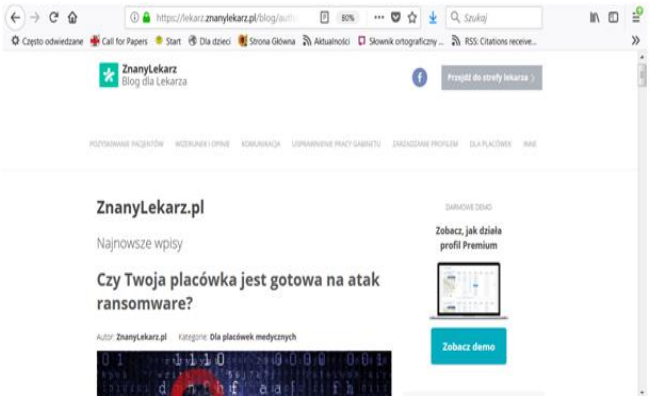

Fig. 2. Blog – an example of application in health care

The next technological element of Web 2.0 is AJAX (Asynchronous JavaScript and XML) – a technique for creating web applications. It allows downloading and sending part of the data without the need to reload the entire website, and thus it simplifies the use of the websites. It is not a new, independent technology, but only a new way of thinking about web applications using existing solutions: XML, CSS, JavaScript, and DOM. The results show that AJAX was used by all of the analyzed websites.

The last element of Web 2.0 included in the website analysis is Ruby on Rails – a framework for building applications written in the Ruby programming language. Since its public release in 1995, the popularity of this programming language has been consistently increasing. Ruby is ranked among the top ten on most indexes measuring the growth and popularity of programming languages in the world (such as the TIOBE index). Ruby owes much of this growth to the popularity of software written using it, especially the Ruby on Rails framework. Ruby is completely free (this applies to the using, copying, modifying and distributing this language). The results show that none of the examined websites is based on the use of this language.

Summing up the technological aspects of Web 2.0, it should be noted that the analysed websites still have a lot of potential for using Web 2.0 technologies. A number of them do not use the technological solutions related to Web 2.0 in a wide scope. The complete list is presented in Figure 3.

The most significant change in the years 2018 and 2020 can be observed in the use of Wiki and Ruby technologies. That means that health portals in Poland have started to use content management systems (CMS) and are paying attention to tagging their information.

At the same time, there are questions that may be the subject of further research in this area. Does this state of affairs affect the functioning of these websites and their popularity? Or will their introduction only constitute an additional workload and additional costs without being translated into possible benefits? Or maybe technological progress is so fast that the technologies mentioned in the literature (e.g. RSS or ATOM) are already outdated and it is worth looking for new solutions in this area?

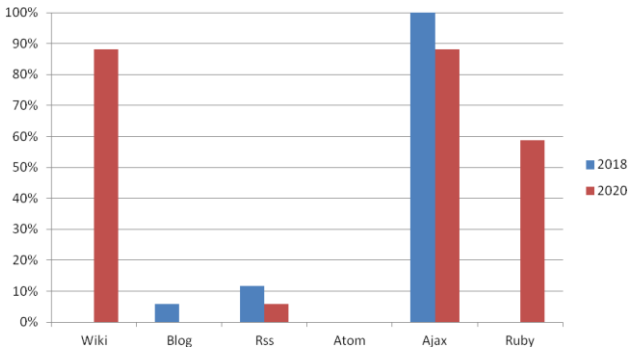

Fig. 3. The structure of the use of Web 2.0 technologies by Polish health services in 2018 and 2020 (source: own study)

3.2. Empirical research – social aspects

The social area of health services was also analysed. It was checked whether they offer forum and newsletter functionalities and whether they appear on social media (Facebook, Twitter, Google+, Instagram). The results obtained are shown in Figure 4. An interesting fact is that the social elements on the health web pages decreased in 2020 compared to 2018.

In the social area, there was greater involvement of the examined websites than in the field of using Web 2.0 technologies. This confirms the incredible power of social media's influence and their expansion in the modern world.

Social media is an attractive information channel with, among other things, many educational advantages. It is also an alternative form of education and upbringing in the field of promoting a healthy lifestyle. The essence of social media and its potential in the field of health education is primarily associated with its huge reach, which is very important for the spread of health education. It enables immediate access to specific social groups that are online. On social networks, there is the phenomenon of creating support groups, ties, building and developing interpersonal relations around topics discussed on the Internet (including those regarding health and life protection). This channel is also very attractive for marketing, so it often happens that educational content is a camouflaged form of advertising. The flood of information, often contradictory and controversial, can also harm health education.

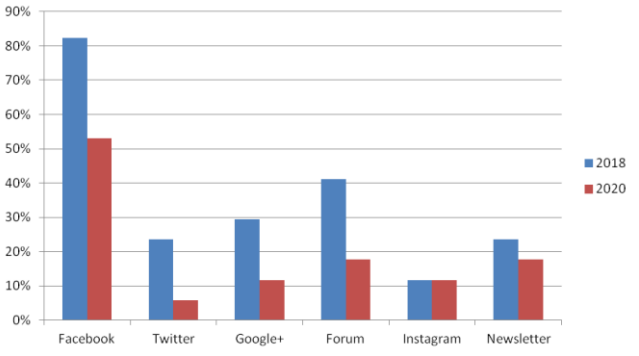

Fig. 4. Structure of the occurrence of social elements in Polish health services in 2018 and 2020 (source: own study)

Social media are distinguished by the free flow of information from their participants. In social media, the information spreads in a viral way (quickly and uncontrollably). The big advantage is multitooling – it's easy to create and publish information not only in the form of text, but also other attractive files. Multi-channelling allows the systematization of incoming information from various sources in the network. Activity on social media is measurable – numerous statistics motivate to action, and determine the level of support for the creator of the information provided and its attractiveness [10].

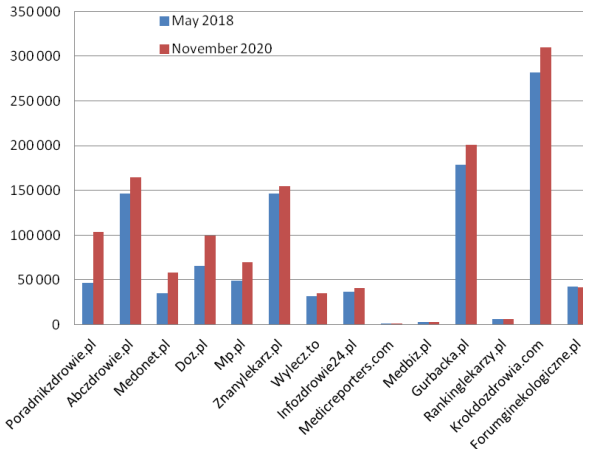

Fig. 5. Number of Facebook fans of chosen health portals in the May 2018 and November 2020 (source: own study)

Figure 5 presents the number of Facebook fans for chosen health services in May 2018 and November 2020. The leader in the ranking is *krokdozdrowia.pl* with the number being over 300,000 fans. *Gurbacka.pl* is in second place (about 200,000 fans). *Abczdrowie.pl* and the *znanylekarz.pl* have over 160,000 fans each. For the other websites, the number of fans does not exceed 110,000.

The next graph (Figure 6) shows the percentage change in the number of fans of chosen health services over a period of 2 years (from May 2018 to November 2020). The dynamics of the changes is wide and ranges from +120% (*poradnikzdrowie.pl*) to -5% (*medbiz.pl*).

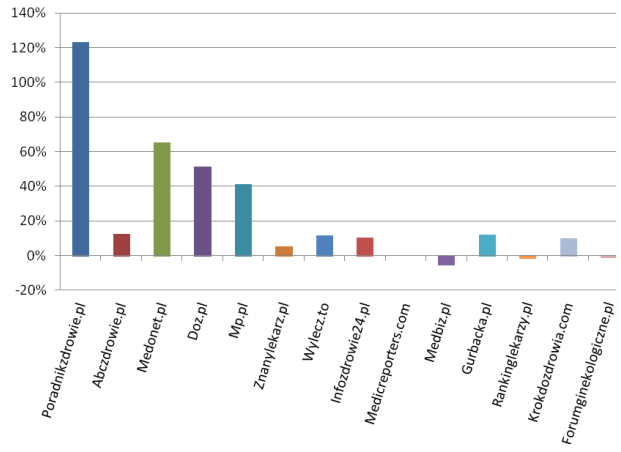

Fig. 6. Change in fans over the period of May 2018 to November 2020 (source: own study)

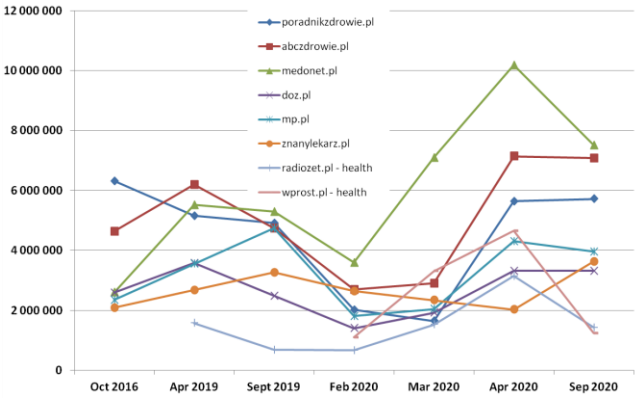

Fig. 7. Change in users over the period of October 2016 to September 2020 in chosen health services (source: own study)

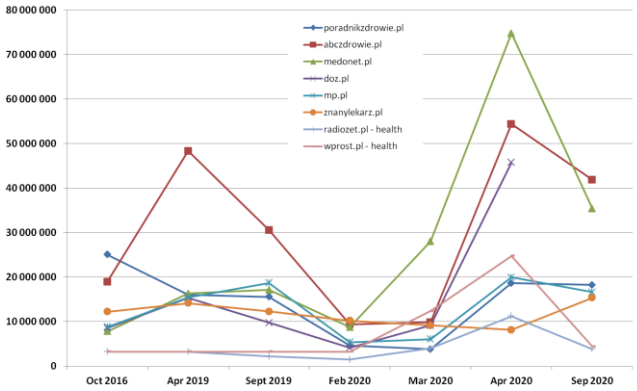

Fig. 8. Change in views over the period of October 2016 to September 2020 in chosen health services (source: own study)

Figures 7 and 8 present the change of the users and the views of the health web sites in the period of time starting from October 2016 until September 2020. This summary was prepared on the basis of the data from Tables 1–6. One can notice that *medonet.pl* and *abczdrowie.pl* are the top two health services in Poland.

The allocation of medical knowledge on forums, blogs, and information portals, using Web 2.0 technologies is a reaction to the growing needs of Internet users as prosumers in the area of health protection. On the other hand, the more common use of social media results in changes in attitudes and behaviors, and also forces the modification of functions and capabilities of information systems. According to Web 2.0, even end users (consumers, patients) can be seen as experts, and their collective wisdom can and should be used (a health care professional is an expert in diagnosing the disease and the patient is an expert in its experience) [4].

The cyclical research conducted in 2013–2019 indicates the fact that the most frequently used ICT tools are Internet forums and discussion groups (about 70% of respondents), specialist medical portals and information websites dedicated to health and Internet encyclopaedias (e.g. Wikipedia) [9].

Social media gives everyone who wants it, the opportunity to share knowledge and information. This is a very positive solution. They also shape the skills of searching and using various sources of knowledge. Users participating in online communities gain the opportunity to self-fulfil, develop interests and use information provided by other Internet users.

Unfortunately, misuse of social media causes threats. The poor quality of content entered by users may reduce the credibility of websites. Users do not take responsibility for the quality of their content. Information appears in the web in a chaotic and distracting way. There are no mechanisms to control and verify the quality of this information. Quantitative data (statistics of visits, likes and shares) often stand in for the value of information. Content creators do not guarantee that the content they provide will be valuable and reliable. There are examples of low-quality substantive information. Such information misleads their recipients. The evaluation of the quality of online sources of health information is a very important issue that is of interest to specialists in medicine, information technology and knowledge and information management.

4. Conclusions

The main conclusion that can be drawn from the study is that the most popular Polish health websites have the character of Web 2.0 websites.

They use technological and social elements of Web 2.0. They use social elements to a greater degree (forum functionalities and newsletter as well as the presence of their profiles on Facebook, Twitter, Google+ and Instagram) than technological ones (Wiki, blogs, RSS, ATOM, Ajax, Ruby).

An interesting behavior of the Internet users can be noticed while comparing the popularity of the websites from Tables 1 to 6 and the number of Facebook fans from Figure 5. The popularity of websites does not reflect the number of Facebook users following the website's profile. The following health portals (in descending order): *krokdozdrowia.pl*, *gurbacka.pl*, *abczdrowie.pl*, *znanylekarz.pl*, have the highest number of Facebook fans (above 140,000). The portal *krokdozdrowia.pl*, which is moderately popular, has the highest number of Facebook fans (over 300,000).

One can notice that the number of Facebook fans of health sites in Poland in the years 2018 and 2020 mostly increases (Figure 5), however the number of registered users of the health sites changes rapidly in the years 2016 and 2020 (Figure 7).

The obtained results confirm the impact of social media. Users in many cases are more likely to visit the profiles of specific pages on Facebook than their web counterparts. In the case of the COVID-19 lockdown in Poland (April 2020), one can observe that users are more willing to register on the websites than to be Facebook fans (Figures 7 and 8). On the other hand, after unfreezing the economy in the summer, a change is noticeable and in September 2020, leading heath sites recorded declines in users and views.

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