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E-HEALTH ACTIVITY IN SOCIAL MEDIA ENVIRONMENT

The article explores health activity in social media environment. The integration of social media into e-health is examined, various types and target of medical social networks are studied, the types and fields of activity of healthcare professionals and patients in social media environment are reviewed. Opportunities for using crowdsourcing technology in social networks are identified, and the risks caused by virtual medical resources are analyzed. The key trends and scope of medical social networks are defined and segmented according to the users' interests, and mutual relationships among them are studied.

Keywords: e-health, social media, medical social networks, healthcare professionals, e-patient, risks factors.

Introduction

Social media is an Internet technology that generates and distributes information through virtual societies and networks. At present, there are many social media tools available to health professionals. They are network platforms, blogs, micro blogs, wikis, data exchange sites, virtual reality, etc. These tools serve to improve professional networks, to develop public health programs, and to educate patients. Using social media resources, the patients can get information about their health and illness; share their experiences in the treatment of certain illnesses; get information about doctors; consult with doctors and get advice and recommendations; and independently make decisions referring to the medical information.

Social media has also created a wide range of opportunities both for doctors and patients. At present, doctors using social media are able to: watch conferences and consiliums without leaving the workplace; hold discussions with colleagues; provide decision support in clinical situations for nurses; and involve professional staff to raise personal potential..

Thus, these opportunities provided by the social media for the patients and physicians, the integration of e-medicine and social media opportunities, and the work of medical professionals, physicians and patients in social media have shaped different virtual relationships. The systematization and classification of these relationships and analysis of decision support in the relevant segments require comprehensive research.

On the other hand, social media creating these opportunities cause serious threats such as dissemination of false information, spoiling professional image, violating patient and doctor confidentiality, breaking personal and professional relationships, and other similar potential risks. Therefore, it is important to analyze the risk factors of social media in e-health environment.

Integration of e-medicine and social media opportunities

The concept of "social media" is a term expressing the combination of new social technologies with interactive elements such as multimedia, audio and text. Social media may also be called "Web 2.0" or "social networking". Social media enables each individual to benefit from various services. One of these opportunities is to get the necessary information and valuable materials about people and companies by using social networks, forums, blogs, news and entertainment portals. To access these materials, each person should be identified and register in these sources and upload required information about himself/herself.

Social media can be grouped as follows:

- social networks (*Facebook, MySpace, Google Plus, Twitter*);
- professional networks (*LinkedIn*);
- media sharing networks (*YouTube, Flickr*);

- content production (blogs (*Tumblr*, *Blogger*) and microblogs (*Twitter*));
- data collection (*Wikipedia*).

Medical social networks. At present, various types of medical networks are available in social media. One of them is *Sermo*, a social networking community for doctors. Comprehensive information about new members is collected during the registration. Members of the network include 68 doctors from 50 states of the US. They discuss treatment methods and consult with experts through the network. The number of doctors in *Sermo* reached 260,000 in April 2014. Most doctors use pseudonyms to provide anonymity [1].

Doximity is a social networking community for doctors established in March 2011. According to the 2015 report, this network has more than 500,000 members. *Doximity* is considered to be the most powerful medical network in the United States in 1996, according to the *Health Insurance Portability and Accountability Act (HIPAA)* adopted in the United States [2].

Networks, such as *The Medical Directors Forum*, *QuantiaMD*, *Doctors Hangout*, *Doc2Doc*, are important platforms for healthcare providers to communicate and collaborate with each other and patients.

Student Doctor Network, the US and Canadian famous Internet resource, assists students to get access to higher education, physicians and veterinarians to do internship. This website has 40,000 active members and 1,5 million visitors per month. Social networks *SHP Connect*, *PharmQD*, *The Pharmacist Society* are available for pharmacists [4, 5], whereas social networks *ANANurseSpace*, *NursingLink* and *SocialRN* bring nurses together.

Blogs. The first blog was created in 2004. The blog is a personal magazine as a website comprising different types of information, ideas, comments, and hyperlinks. At present, blogs are considered as one of the strongest Web 2.0 and new media tools. Created by *bloggers* the blogs have a wide audience. Information of great interest is often shared by readers for multiple times. Data is presented in various forms - text, video, audio. *Tumblr*, *WordPress*, *Blogger* are the most widely used blogs.

Most doctors use blogs to communicate with other health care professionals or societies. For example, the *Clinical Case* massively brings together medical professionals. Moreover, it includes special sections that contain records and guides. Pharmacists are more interested in blogs.

Microblogs provide information exchange in a more dynamic and brief form via social media over a short period of time. *Twitter* is the most commonly used microblog. It is used by *Twitter* in *Twitter* for real-time discussions and presentations in conferences, exchange of information between students and teachers, and student monitoring [7].

Wikis. Wiki is a public web site. Users may upload and edit text, multimedia, and content here. *Wikipedia* is widely used in medical society. Although *Wikipedia* is not a reliable source, most medical professionals use it. Thus, surveys show that 19% of pharmacists do not trust this resource; however 35% of them use it. One of the key features of *Wikipedia* is its popularity in *Google* search engine [8].

Media-sharing websites. Medical-mediated media-sharing websites can be an important resource for teaching, public health awareness, and marketing. Media-sharing website is easy to use, and provides users with free registration and ensures both computer and mobile device access. *Youtube* is the most commonly used media-sharing website. Another media-sharing website for health professionals may include *The Doctors Channel*. The most interesting videos about medical innovation, medical education and health are uploaded here [9].

Professional networks. Establishing a certain social network for each specialty has always been a matter of time. In recent years, the massive use of social networks has led to the development of professional communities. Since 2000, social networks of doctors have begun to function in Western countries. These social networks may include *Sermo* (www.sermo.com), *Doc2Doc* (www.doc2doc.com), *Ozmosis* (www.ozmosis.com), *Healtheva* (www.healtheva.com) [10]. In 2010, more than 700 medical centers in the US created corporate social networks to

improve the services delivered to patients, to seek and recruit medical staff, and to sign agreements with pharmaceutical companies and medical technicians [10].

LinkedIn is a professional social networking website with an average of 1.5 million healthcare professionals registered for job search and professional development. It is a useful tool for healthcare professionals to look for work, identify a highly-qualified employee, and learn more about any company or its employees. Health professionals registered in the *LinkedIn* are doctors, providers, researchers, managing staff, pharmacists, and biotech workers and managers [11].

The number of users in social media is rapidly growing. The use of social media in the United States has increased from 8% to 72% in the period from 2005 to 2016. In 2002, the number of *Facebook* users throughout the world exceeded 1 billion. In *Twitter*, 100 million active users send 65 million tweets (messages) per day and two billion video are uploaded on *Youtube*.

The study of various types of social media shows that they are used for the following purposes:

- more rapid access to information;
- establishing contacts with local and remote communities;
- sharing ideas;
- expansion of medical education;
- establishing relationships with people;
- establishing labor relations;
- conducting researches and discussing results;
- searching for job vacancies, etc. [12].

Analysis of social networks identified that 42% of reviews of social media is related to search for healthcare information, 30% - for moral support for patients, 25% - for personal experiences, 20% - for medical forum attendance and community membership.

Activity of medical professionals in social media

Social media provides medical professionals with necessary tools to share information, hold health policy debates, observe health-related behaviors, communicate with population, patients, their guardians and partner-students, and to be educated. Health professionals use social media to seek information on potentially reducing medical costs, get medical innovation, motivate patients, provide information to citizens, and to be informed about the civic satisfaction with the quality of medical services.

Doctors join online societies to read new articles, listen experts' lectures, conduct medical research, appoint precise diagnosis, and consult with colleagues. Doctors can share ideas and medical experiences, conduct discussions for problem solution, post summaries, discuss and sell research works.

The survey *QuantiaMd* conducted among 4,000 physicians has shown that 90% of doctors use social media for their personal activities, whereas only 65% of them benefit from websites for their professional activities. Social network *Доктор на работе* is registered as a specialized scientific-medical mass media to attract experts and shares scientific articles and clinical researches on its website. For example, video section of social network *Медтусовка* contains interviews of prominent doctors, video conferences and educational videos.

Thus, doctors receive the necessary information, share their observations on medical issues, treatment methods, experiences related to the modernization of healthcare and make important decisions. In addition, doctors can publish articles free of charge, and earn money and extras [13].

Annual report of the *Manhattan research Taking the Pulse* confirms that only 22% of European doctors used social networks in their activities in 2012, and this figure increased by 13% in the following years. *Bayer Healthcare China's* report for 2009 shows that 97% of physicians from five major cities of China were the members of social networks. This figure in the UK was accounted for 48% [14].

English-language portal *Healthcare IT news* held a survey among doctors, which showed that 87% of doctors used social networks in their activities [15].

Unlike doctors, pharmacists rarely use social media. They are mainly accessing social networking on pharmacy. Surveys show that many pharmacists often use *Facebook*. *Facebook* includes more than 90 pages related to pharmacy. For example, *Pharmacists Interest Page*, the *American Pharmacists Association*, and the *Cynical Pharmacist*. According to the 2011 survey, 38% of pharmaceutical faculty graduates use *Facebook* for education, and only 10% of pharmacists prefer *Twitter*.

Online social media platforms assistance for nurses to expand their educational experience. With the use of *Twitter*, 53% of nurses develop their skills to make decisions in clinical situations.

American College of Physicians and the Federation of State Medical Boards initiated a new conceptual document to guide physicians to follow ethical standards while using social media, how to apply professionalism principles online, preserve mutual trust between patient-physician relationships, and take into account the interests of patients [16].

The main provisions in this document contain the followings:

- not to interfere personal life of the patients;
- to be sure of the professional level of shares and comments before they are shared;
- to take into account the probable damage to the reputation of physicians before posting shares and comments online and non-professional shares ;
- to ensure complete data privacy of the patients;
- to divide the content to be shared in social network into personal and professional parts.
- to establish patient-physician relationship and ethic norms in the course of communications, being patient and accurate.
- not to add patients to "friend" list or confirm "friend" request.

E-Patients and Social Media

In the 90s of the last century, the concept of *Patient 1.0* appeared. Patients used information technology to search for medical information [17].

In 2008, a new term - *Patient 2.0* (E-Patient) emerged. These patients are now using information technology not only for medical information search, but also to share that information in social media [18].

Representatives of *Patient 2.0*, unlike *Patient 1.0*, are well informed about the symptoms, schemes, and treatments of illness and concerned about their health and its strengthening methods. Prior to visiting the doctor, *Patient 2.0* is surfing the Internet for their illness, treatment and symptoms. They share their experiences related to the treatment results obtained from these or other doctors, hospitals, medication and treatment deficiencies on social networks [19, 20].

The term E-Patient (*Patient 2.0*) was first offered by Tom Ferguson in 2007, and his article on this problem was published after his death in 2017 [21]. The article recommends the patients to collect information about their personal health from the Internet and share this knowledge with other patients, while the physicians are told to collaborate with patients in the treatment process.

E-patient attempts to get more information and knowledge regarding their own health through the Internet and medical social networks. Therefore, e-patient gets an opportunity to participate in the decision-making process concerning the treatments. Today, the concept of "responsible patient", who is able to make independent decisions, is getting popular in the world. Involvement of a citizen in the protection of his/her own health has become an integral part of the policy of a number of states [22]. Thus, the combination of patient-oriented medicine, social media and the Internet has opened a new era in medicine of the 21st century.

In recent years, patients have been actively involved in addressing their health problems viewing them as a source of information. They reveal the answers to several questions by referring to the information shared in media regarding patients' attitudes toward these or other medical

problems. The phenomenon of obtaining additional information through social media is called "real world evidence" in international medical environment. In social media, patients share their personal medical information in groups, discuss them, and are morally supported by those who have previously experienced this disease. In some social networks, patients create platforms called "data-sharing", where they share information on their health condition aiming at getting their revenue [23]. Here, patients share information on their own conditions, symptoms of the disease and treatment costs, and the members benefit from this information. This means that doctors and medical professionals get the results of testing and surveys without funding. Furthermore, this type of patient information leads to new clinical trials [24]. For example, as a result of studies conducted on these platforms, the effect of lithium therapy on the development of amyotrophic sclerosis has been revealed, and in the further studies this procedure has begun to be applied.

Most patients use the following social networks and social media platforms: *Smart Patients*, *Stupidcancering*, *e-patients.net*, *Woman Heart Support Community*, *babycenter*, *Daily Strength and Facebook*, *Twitter*.

PatientsLikeMe [25] and *Treato* [26] are supporting only e-patient societies. *PatientsLikeMe* is designed to analyze the types of therapy (including preparations), symptoms, possible complications, and other aspects based on the treatment experience of various diseases. One of the main issues of this resource is finding similar diagnosed patients and creating opportunities for users to examine their treatment experiences. On the other hand, a user is able to monitor his/her own health. The database of the resource represents more than 400,000 members of society, about 2500 cases of illnesses and over 35 million facts. The information presented in the database and the results of their analysis can also be used in research in medicine and pharmacy.

Treato is an automated monitoring tool of leading web sites and portals (social network, forum, etc.). *Treato* data shows that the system has analyzed 2,399,748,414 data about 24,748 cases/symptoms and 26,616 preparations/treatments thus far. The analysis confirms that the main "scope of interest" is medicines and diseases [27].

The studies show that e-patients are using social media more than traditional patients for searching for medical knowledge.

Table 1.

The ratio of e-patients and traditional patients using social resources [23].

e- resource	e- patient	ordinary patient
Wikipedia	53%	17%
Using social networks such as <i>MySpace</i> or <i>Facebook</i>	39%	17%
Using blogs	37%	10%
Creating blogs	13%	4%

E-Patients collect health information using various information technology services. Obtained information covers various aspects of medicine. The results of surveys show that e-patients are mainly focus on the following medical information [28]:

- 33% - weight gain or loss;
- 27% - health insurance;
- 18% - establishing contacts with other e-patients with similar health problems;
- 12% - regulating the health condition during visits abroad.

Social media and crowdsourcing

Medical social networks are important online platforms for hundreds of thousands of people to get information about their health, share views, discuss symptoms and treatment methods, make joint decisions, get moral support, and get acquainted with new treatments.

Crowdsourcing is a form of volunteer co-operation through a large number of people on the Internet with their potential (knowledge, experience, ideas, services, etc.) to solve any problem. [29]. The essence of crowdsourcing is that the results achieved together with the knowledge of thousands of initiatives (collective intellectuals) are much better than of those produced by one or couple of experts.

In the social networking environment, crowdsourcing technology can be effective in diagnosing the patients with rare diseases. Thus, crowdsourcing provides accessibility of knowledge, judgments and specific experience of thousands of people (including those with severe diseases and cured patients, former and practicing physicians, practitioners, and persons with independent medical knowledge) in the social media for the solution of various medical problems or projects.

Doctors can get information about alternative diagnostic options and their probabilities for the treatment of a complicated disease using crowdsourcing.

E-patients can assist doctors in obtaining the necessary medical data and similar case studies. Hence, this type of patient shares the symptoms, demographic indicators, or the relevant parts of their health care card on the social network and accesses a "wise collective decision" made by experts and cured patients on the diagnosis and treatment of the disease.

Webicina, for example, is one of the social networks using crowdsourcing services [30]. It contains sections for patients and professionals and each patient can get reliable recommendations and medical information from this resource.

Social media benefits in e-health

Despite technical advances, physicians are always overloaded with patient appointments and reports. They often do not have enough time to use scientific and medical libraries, read scientific articles on their specialty, conduct professional discussions with more experienced colleagues, argue about effective treatments of various diseases, and get information about new medical diagnostics equipment, new perspectives and adverse reactions of medications [31].

Social media solves all above mentioned problems. Physicians can organize consilium without leaving work place, discuss clinical situations with experienced colleagues, get recommendations, watch interesting speeches at scientific conferences, and seek job vacancies.

For physicians, social media is a powerful tool for sharing, collecting, and editing information amongst participants. Moreover, it is a strong source for advancement in career and influencing the audience entirely.

In addition, medical institutions also benefit from social media. Thus, social media is the most comfortable Internet site for medical institutions to search and recruit medical staff. At the same time, social networking resources allow healthcare providers to promote the medical institution.

One of the possibilities of social media is its use for the development of education, especially in establishment of academic libraries and virtual classes, and hiring students.

Risk factors of social media in e-health

Along with the advantages of social networks, they have risk factors that can undermine their potential too.

First, some resources have a long registration process. For example, social network *Доктор на работе* consists of health professionals. Its registration requires uploading a job address, information about the educational institution, diploma number and copy. Facing such difficulty, doctors interrupt the registration process. Even the popular American social network *Sermo* requires the specification of specialty, address of educational institution, address of workplace, and identification number of professional activity.

One of the major threats to social media is the misrepresentation of the content, the poor quality of content uploaded by non-professional users in real-time mode, and low-level and non-professional debates.

In social media websites, the authors of medical information are mostly unrecognized doctors with limited facts. In addition, medical information is sometimes unreliable, incomplete and informal. This forces highly qualified specialists to leave the social network. At the same time, there are doubts about whether the information is accurate or up-to-date, which decreases the number of users [32].

Therefore, health care professionals recommend patients to access more reliable sites to get better quality information. The World Health Organization (WHO) recommends using the Internet Corporation for Assigned Names and Number, which guarantees the reliability of all medical information. Web sites with similar domains are constantly checked and ensured to meet the required criteria [33].

One of the reasons undermining the power of social media is the threat of dissemination of personal data of patients. The violation of personal confidentiality of physicians during online communication is also referred to social media threats. Thus, patients can send physicians a friendly request on *Facebook*, though most physicians do not accept this friendship to prevent their privacy. Instead, health professionals offer the patients developing a website. For example, the portal *Caring Bridge* is a non-profit resource, where mass medical information is provided for patients and their privacy is protected. Patients can easily interact with doctors via *Caring Bridge* [34].

The attitude of a manager of medical institution to its employee may vary depending on his/her profile on the social network, shares, recommendations, and comments. Thus, social networks require doctors to utterly follow ethical norms and behavior standards. It is advisable to be sufficiently cautious and attentive during the discussion.

Social media has already become a successful business in the field of e-medicine. Business relations of social media are largely shaped due to collaboration with pharmaceutical companies and medical equipment manufacturers. The risk factors in this segment are often observed in the violation of legal norms.

In depth research on the prevention of the listed risk factors is conditioned by the rapid growth and expansion of social networks and regulated within rules and norms specified and coordinated by relevant health care institutions and organizations [18].

Social relations in e-health

Study of various types of medical social media resources allows identifying their trends and main scopes (users). This, in turn, has resulted in the segmentation of users by their scopes and the development of certain types of requests and relationships in the virtual space. Depending on these relationships and requests type, scenarios for decision-making can be set in the social media environment. As a result of the research, we have found the following relationships in medical social media (Figure 1):

- **Physician - Physician relations.** Using social media, physicians can discuss effective treatment methods of various diseases with their colleagues, provide professional advice on clinical situations, conduct scientific negotiations, develop their medical knowledge, and make accurate decisions in clinical situations. Simultaneously, physicians can watch real-time scientific workshops of more experienced professionals, their surgical operations and instructions.
- **Physician-patient relations.** Physicians use social media to communicate with patients, observe their health, give advises and monitor them. Preserving ethical norms in physician-patient relationships, taking into consideration the interests of the patient is one of the basic requirements.

- ***Patient-patient relations.*** Patients use social networks, mostly in search of the following information: [38]
 - diseases, symptoms, diagnosis and treatment;
 - medicines, their use, and adverse reactions;
 - opinions of other patients about doctors and their treatment methods;
 - information about medical centers;
 - finding an identical diagnosed patient, sharing experience in combating certain illness;
 - new approach to treatment and high-tech medical care;
 - use and contraindications of traditional treatment methods and techniques;
 - psychological problems, depression and moral support;
 - information on diet;
 - online consultations with physicians and pharmacists;
 - online purchase of medicines, etc.
- ***Physician-pharmaceutical company relations.*** Physicians get information about the medications produced by pharmaceutical companies through social media and get acquainted with their instructions and adverse reactions. Accordingly, doctors prescribe new therapeutic treatments, share information on social media about the poor quality of certain medicines, and call pharmacists to stop producing these drugs.
- ***Pharmacist-advertising company relations.*** Social media provide successful business opportunities for pharmacology. Thus, pharmacists contract advertising companies, promote and sell medications in social media, and correspondingly, advertising companies also benefit from this joint venture.
- ***Physician-patient-nurse relations.*** The therapeutic process depends largely on the relationship between physicians and nurses. The absence of mutual understanding and harmony in these relationships diminishes the quality of medical services. The emergence of social media has also brought innovations to the relations. Thus, online social technologies such as e-mail and computerized order have enabled physicians and nurses to communicate without interruptions, monitor the patient's treatment, and get information and follow doctors' instructions. At the same time, relationship between the patient and the nurse is also important. The nurse constantly provides moral support to chronic patients in social networks. This improves the emotional condition of the patients and thereby positively affects the course of treatment. Social media has a wide range of possibilities particularly for establishing such relations with the patients with hazardous health problems.
- ***Physician-medical clinics relations.*** Social media has a fundamental role in these relations. Hence, social media is the most comfortable way to search and select medical staff for medical institutions. Managers of medical institutions get information about doctors visiting their pages on popular social networks (e.g. *Facebook*) or personal medical sites to identify the extent of their professionalism based on opinions of patients about their treatment methods, treatment results and experiences. Thus, social media plays a fundamental role for both subjects of the medical-clinical relationship.
- ***Patient-medical clinics relations.*** Social media has created many advantages for patients. Using social media sites, patients can access the clinic, its address, contacts and detailed information about medical staff and appointment rules, including the web site of that clinic.

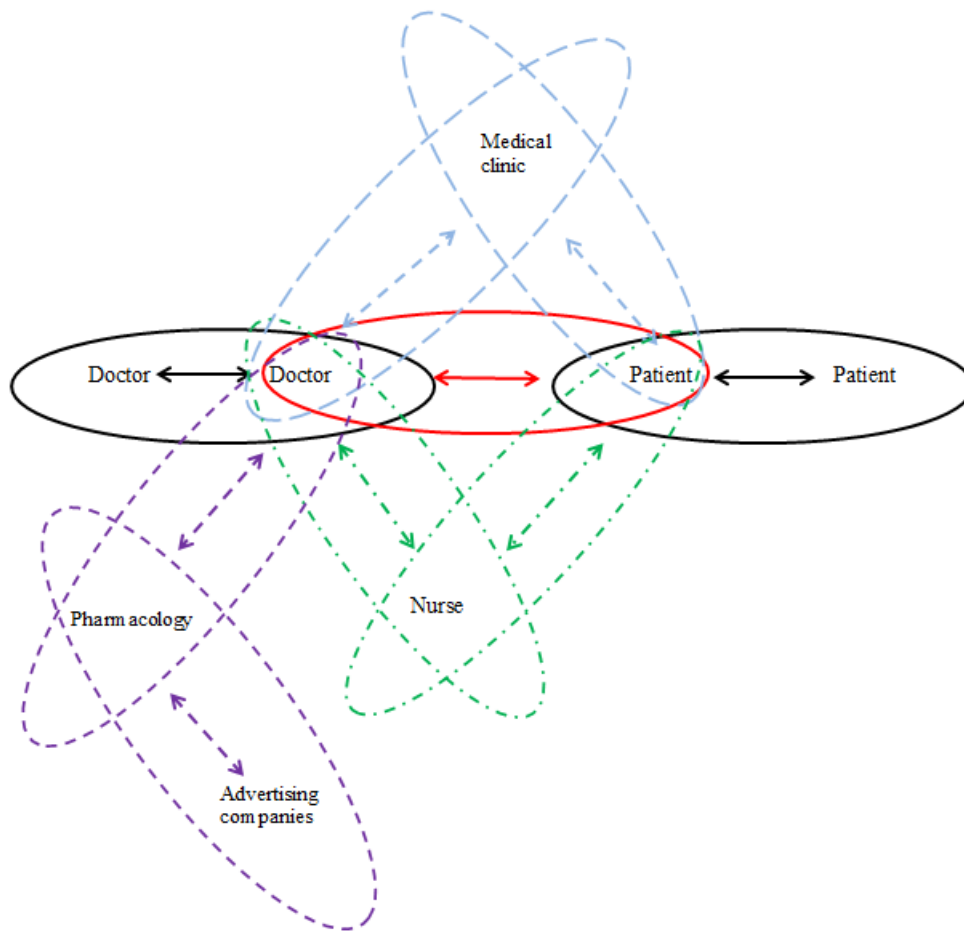


Figure 1. Relationships in medical social media

Conclusion

Conducted analysis showed that social media became an important factor in the development of healthcare system, and over time, it would be more influential in the activities of doctors, patients and healthcare providers. In social media, the number of communicator-users grows steadily and their forms of activity vary. From this point of view, new virtual relations are being shaped. This article classified them as the relations between physician-physician, physician-patient, patient-patient, nurse-physician, nurse-patient, medical clinic-physician, patient-medical clinic, etc. Depending on these relations and possible requests in certain relations segment, the scenarios of decision making in the social media environment are formed.

When using social media, content distortion, real-time upload of poor quality content by non-professional users, conducting low-level and non-professional debates, disseminating personal information of patients and physicians, violating ethical norms and behavioral standards in the specified relationships undeniably cause the emergence of risk factors. The article substantiated the importance of developing appropriate rules and norms for prevention of such risk factors and establishing specialized health care organizations.

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