Review articles

Internet in medical activity

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ABSTRACT. The paper presents ample opportunities to use the Internet to effectively support medical activities. The presented considerations include prophylaxis, diagnosis and treatment, monitoring the patient during convalescence, medical education and hospital administration elements. The major importance of multimedia software, virtual reality and artificial intelligence algorithms for the effective operation of the telemedicine systems have been accentuated. In the paper the main tasks of telemedical systems connected with the following domains have been presented: 1) prophylaxis – indication of the risks of improper lifestyle and environmental degradation coupled with recommendations on the ways and means of diseases prevention and methods for self-control of health; 2) diagnostics – offering multimedia algorithms of diagnostics procedures; 3) therapy – providing multimedia algorithms of therapeutic procedures and of multimedia information on medicine administration; 4) care during convalescence – constant remote monitoring of the patient's condition and assurance of quick contact with doctor; 5) medical education – offering attractive presentation of medical knowledge in the diagram form of diagnostic ortherapeutic algorithms and providing simulators creating correct habits in medical procedures; 6) hospital administration – providing comprehensive information about a hospital or clinic functioning for a potential patient and exchange of information concerning patients between hospitals. The paper presents conclusions about conditions of greatest usefulness of telemedicine systems.

Key words: Internet, medical activity, telemedicine

Introduction

The constant development of computer networks and a huge increase in the number of their users, particularly as concerns the Internet being an extensive worldwide computer network, create special opportunities for the effective rescue of human health or life, or prevention of diseases or pests. This effectiveness is related to both the universality of access to Internet sites and clever use of the latest advances in programming tools and technical means of informatics for the presentation of a good script and a high level of communication with the system.

The essential conditions for the effective support of medical activities by the Internet are: 1) fixed easy access to the Internet; 2) selecting appropriate content of medical knowledge and presenting it in the form of multimedia algorithms; 3) extensive use of communication multimedia, virtual reality and artificial intelligence algorithms; 4) use of the latest technical means of informatics.

Huge resources of knowledge related to parasitology are stored in the world Internet in multimedia form. It concerns the Polish Google too, where we have an easy access to heterogeneous form of knowledge presentation related to parasitology. For example: information on Nemathelminthes and Platyhelminthes [1], popular scientific information related to parasitology [2], introduction to genetics and parasitology for physicians [3] and for nurses [4], valuable colorful films on parasitological issues with spoken comments [5].

The presented considerations include prophylaxis, diagnosis and treatment, monitoring

the patient during convalescence, medical education and hospital administration elements.

Prophylaxis

Using Internet pages in prophylaxis concentrates mainly on public awareness of the etiology of disease, the risks of improper lifestyle and environmental degradation together with an indication of the ways and means of diseases prevention. It can give valuable results, provided the following requirements are met: 1) selection of the appropriate content and its clear wording; 2) using ingenious scenario; 3) attractive presentation based on multimedia and virtual reality; 4) indication of methods for self-control of health.

For instance, Stempczyńska and Małolepszy [6] present Internet application to dissemination of cancer disease prophylaxis encouraging early detection of tumours. The authors asserted that thanks to well-applied multimedia and virtual reality in the presented method, it is possible to obtain very good results. But the paper „Teleprevention of civilization diseases" [7] deals with the whole range of diseases related to cardiovascular diseases, cancer, diabetes, stroke, mental disorders and includes a number of good examples of telemedicine uses in the abovementioned domains.

Diagnostics

Online support for diagnostics is mainly addressed to the personnel of small health centers and outpatient treatment away from hospitals and clinics, where a doctor or qualified nurses frequently have to establish a diagnosis and decide on what action to take, for example whether to institute treatment or transport a patient to a facility with sufficient specialist and technical means, as well as pharmaceuticals.

Internet support constitutes easy access to: 1) visual and sound patterns (static and moving); 2) multimedia instructions illustrated with static or moving images associated with sound; 3) remote consultation (for example by Skype); 4) participation in remote video-conferencing in difficult cases (including remote medical centers).

Currently, a lot of work in the world devoted to research into the design and operation of Internet systems for diagnosis support is in progress. For example: 1) TeleKard [8] – telemedical support system for cardiological diagnostics; 2) hematology and oncology services [9] including a database of chemotherapy protocols; 3) a system to assist the diagnosis of anemia [10]; 4) the concept of decentralized decision – diagnostic telemedical system [11], and many others.

Multimedia presentation [12] entitled „Diagnostic Parasitology" is a good example of the Internet support for parasitology diagnostics. This study elaborated by University of Delavare includes 22 cases of intestinal parasites and 18 cases of extra-intestinal parasites. In each case adequate commentaries and coloured images have been given. The path to the presentation is as follows: Google (Polish) – Google USA – Search Google USA for American websites – Parasitology – Diagnostic Parasitology Images (USA).

Therapy

Internet support for therapy largely relates to cases discussed in the previous chapter when instituting treatment must be undertaken by doctors or nurses being insufficiently prepared expertly. The participation in a video-conference can also apply to specialized centers in difficult cases.

Instructions in the form of online static or moving images with sound can also be useful while operating new equipment or introducing new pharmaceutical agents, which in particular relates to drugs having aggressive action.

Armstrong et al. [13] show the usefulness of the Internet in situations when prompt intensive medical care is needed and there are no well-prepared persons for this purpose. In such cases the multimedia algorithms of intensive care presented in a very communicative form are of major significance.

Currently, there are a lot of publications devoted to problems of design and operation of telemedicine systems for therapy support. For example: 1) Tele-radiology system MEDICUS: Software Architecture and First Experience [14]; 2) System DiabTel: A Telemedicine Service for Diabetes Care [15]; 3) Danish Centre for Health Telematic [16], and many others.

Care during convalescence

The role of the Internet in convalescence of patients residing outside the hospital includes not only multimedia instructions and recommendations

for their lifestyles and behaviors in different situations, but also constant remote monitoring of the patient's condition and assurance of quick contact with a doctor.

Well-organized system of the Internet care during convalescence period allows the patient to stay with the family while ensuring efficient medical care and, at the same time, delivering cost savings for the hospital. Constant Internet communication between the doctor and patients allows the doctor to remotely view the patients and continuously have current information on the state of their health.

Medical education

Internet medical education can not in any case replace the medical studies in academies, because the medical student must spend a significant part of study time in contact with patients in departments corresponding to different specializations. But properly prepared internet education systems may constitute a substantial assistance in the training of medical students in both theory and practice. This can be applied to all subjects included in the program of medical studies.

The Internet can provide attractive medical knowledge in the form of diagnostic or therapeutic algorithms, simulators creating correct habits in medical procedures, or instructions how to use modern medical equipment. It also serves different types of tests such as the ones for verification of knowledge assimilated by the student. For example, the paper entitled „TELEONC System for Oncology Education" [17] presents a general project computer system and discusses the first conclusions reached during implementation and more detailed elaborations of its particular elements. The system has been created in close cooperation between the Institute of Computer Science at the Technical University and the Department of Oncology at the Medical University of Łódź. Oncology education in the area of diagnosis and therapy comprising radiotherapy, chemotherapy and oncological surgery with a special emphasis put on telemedicine has been designed. It is also expected to teach medical students how a computer can efficiently be used in their future professional work. In the paper „Multimedia Simulator of Patient" [18] the education system for medical students to assist them in learning oncological diagnosing is presented. It enables the student to make diagnosis

on the basis of conversation with the telesystem simulating a patient. The conversation consists of the following actions: 1) the student chooses appropriate questions and medical examinations from a list presented by the computer; 2) the computer replies with the aid of displaying randomly chosen answers on the monitor. The student's task is also to decide each time whether the examination results are within the norm. After taking case history, the student should make a diagnosis, which he does by choosing one item out of the list of ninety-five oncological diseases.

Among a broad parasitology education materials, the film entitled „Check if you have parasites. View the shocking video" is of great importance [5].

Internet assistance of medical education plays a major role in postgraduate studies preparing physicians to medical specialization examinations and in professional continuing education programs [19] for physicians and nurses (for parasitology education [3,4]) .

The role of the Internet in hospital administration

Here are some main tasks that the Internet can offer for hospital administration to the benefit of the hospital and patients: 1) providing comprehensive information about the functioning of a hospital or clinic for a potential patient; 2) remote receiving applications of patients registration to hospital; 3) remote collection of charges; 4) exchange of information concerning patients between hospitals.

Final remarks and conclusions

Issues discussed above do not exhaust all possible tasks for the benefit of hospital work. Modern telemedical systems are constantly created to cover new areas of medical activity with very good results.

The effectiveness of these systems depends primarily on profound knowledge of the functioning of health services and inventiveness in the use of modern computer science. The application of telemedical systems is particularly important for countries located in large, sparsely populated areas, such as Australia, Canada, Alaska, etc. For Polish conditions, the main telemedical system application pertains to problems of patient care in the period of convalescence and in hospital administration.

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