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Anna Lantsberg
Klaus G. Troitzsch

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Kontaktdaten der Verfasser

Klaus G. Troitzsch, Anna Lantsberg
Institut für Wirtschafts- und Verwaltungsinformatik
Fachbereich Informatik
Universität Koblenz-Landau
Universitätsstraße 1
D-56070 Koblenz
EMail: kgt@uni-koblenz.de

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ABSTRACT

The paper is devoted to solving a problem of the development of the website of Russian municipal policlinics and provides a selection of a set of elements which should be posted on a website. Such elements are necessary to provide citizens with correct and ergonomic e-services. The insufficient development of an infrastructure of institutions of public and municipal administration (particularly, healthcare institutions) in Russia made it necessary to analyze web-resources used in different countries at different levels of providing medical services. The information resources of medical treatment facilities of the United Kingdom, of the United States of America and of the Federal Republic of Germany were researched separately for three existing economic models of healthcare. A set of criteria for the assessment of medical web-resources was developed.

Keywords: E-services, E-government, Website, Healthcare institution, Internet, Quality assessment system, Search engine.

INTRODUCTION

One of the issues of current importance of the evolution of the social branch of public and municipal administrations is a partial transformation of services for citizens into e-services. The aim is to simplify a scheme of drawing up documents, partly relieving staff from chores, and to reduce the waiting time of citizens in a queue for services. The results of a head count, held by the Russian Fund of Public Opinion in July, 2010, demonstrate that Russian citizens are ready to pass to a new type of interaction with institutions, providing them with public and municipal services. According to their statistics four out of ten Russian citizens know about the possibility of receiving public services via the Internet. Another three citizens have heard something about this possibility. Every ninth citizen has already used services of public institutions via the Internet (11%), about a quarter would like to use them. Every second person of the forty-five years age group and only five out of hundred persons older than sixty years know about the possibility of using public e-services [1].

This paper is devoted to the research of the peculiarities of e-services in healthcare implementation. Foreign research shows a high interest of medical informatics and information management specialists in developing online services for citizens to be used in all kinds of medical information [2–10]. The usual tool of implementing e-services is a website of a medical treatment facility. Such a website gives users a broad spectrum of additional possibilities, including: a preview of necessary information, receiving of an interactive consultation with a specialist, a possibility of booking an appointment with a physician on-line and a possibility of viewing medical records about their state of health.

In Russia an interest in such research appeared comparatively recently, the development of an overall concept of e-government played an important role. As Russian projects of developing structures of online services are at the initial stage, an attention of this paper is focused on the analysis of functional abilities of foreign websites of healthcare facilities of different levels (from healthcare ministries to policlinics) and on transferring their experience in designing websites for

medical facilities in Russian reality. The aim of this research paper is a description of basic features of the structure of website of municipal policlinics.

Material and Methods

A variety of economic, political, ethical and other relations have an influence on a country's formation of its healthcare system; these relations define individual peculiarities of a country. However the base of any healthcare system is one of three existing economic models of financing [11, 12]:

1. Public medicine with a budget financed system (e.g. United Kingdom).

2. Payment system based on market principles, using private healthcare insurance (e.g. United States of America).

3. Healthcare system, based on principles of social insurance and market regulation with multichannel financed system (e.g. Canada, Japan, and Federal Republic of Germany).

Each healthcare model (particularly, its realization in different countries) is characterized by a three-level system of providing medical services: General Practitioner (Individual practice) − Hospital services − Administrative institution (Table 1).

Table 1. Healthcare models and examples of their realizations

Type of the system	Payment system (market system)	State system (budget system of financing)	System, based on principles of social insurance (funds of health insurance)
Country	USA	United Kingdom	Federal Republic of Germany
Government department	US Department of Health&Human Services	Department of Health National Health Service	Bundesministerium für Gesundheit
Structure	Family Medicine	General Practitioners	Private Practice
	Hospitals: − non-profit hospitals; − privately owned for-profit hospitals; − government hospitals	Hospital and Specialist Services: − Acute Trusts; − Care Trusts; − Mental Health Trusts; − Ambulance Trusts	Hospitals: − Public Hospitals − Private Hospitals − Charity Hospitals
	Public health care: − Medicare, − Medicaid, − TRICARE, − the Children's Health Insurance Program − the Veterans Health Administration.	Local Health Authority Services	
System of financing	36% - private insurance policy		Private Insurance Company (Debeka) (about 23%)
	15% - private person		
	34% - Federal Government		Public Insurance Corporations (AOK) (about 77%)
	11% - State government		
	4% - other private funds		

The difference of these models lies in the degree of the government's participation in financing of healthcare facilities and in their financing structures.

- In the USA, for example, the government pays for a treatment of needy citizens who fall within the scope of welfare programs while all others have to pay from their private funds and eventually get reimbursement from private health insurance contracts if they have any; most of the medical treatment facilities are private, including hospitals and general (family) physicians.

- In the UK a large part of medical treatment facilities is public; furthermore the government pays all the treatment of citizens. Here institutions of the first two levels are subordinated to special national trusts, which are subordinated to the regional strategic healthcare offices. All services of UK medicine are united in the National Health System (NHS).

- There is an insurance system, based on public insurance corporations and private insurance companies, in Germany. Here a large part of medical treatment facilities is private; the payment of patient treatment is accomplished by a complex scheme, where a large part of the treatment costs are either reimbursed or directly paid by the insurance, and patients have to pay some extra charges.

It is worthwhile to say that in all three realizations of the healthcare models at the lower level a system of individual practices of dentists, general and specialized physicians exists. A system of hospital aid financing (a presence of public and private hospitals, hospitals of voluntary and charity organizations) is also similar in all three realizations. The head of each healthcare system is a ministry and its local subdivisions.

The base of the Russian healthcare system is a mixed (hybrid) economic model, which is characterized by a system of social insurance with a prevalence of government financing. The main difference of the Russian model as compared to the US, the UK and Germany is a prevalence of public facilities at the first two levels and a presence of municipal and private policlinics at the low level instead of separate practices of physicians in the European and American models.

Each healthcare system has its own system of information support, which also indicates a degree of development of services for patients (including e-services). The web-resources of the three denoted levels of medical care provided in the United Kingdom, the United States of America and the Federal Republic of Germany are analyzed in this paper with an accent on public institutions (where this was possible). The analysis is focused on revealing common features of Web-resources of different healthcare systems and on tracing the interconnections between E-resources of different levels of providing medical care with the aim of the most effective design of the structure of a policlinic website. The effectiveness of the structure is defined by the usefulness of a policlinic website for the end-user (e.g. patient). In Russia a municipal policlinic is the basic institution of providing different types of medical care for all age groups and social classes. Therefore the degree of development of patient information support facilities at this level is one of the factors of quality and timely treatment.

Sample selection

For each denoted healthcare system an analysis of Web-resources was carried out with a top-down scheme in three categories: public healthcare authorities (central and local); hospitals; general and specialized physicians. Information resources of local authorities were not researched in details. A preliminary analysis of these resources showed that generally their structure and information content are similar to the ones of a higher authority's website. The websites of public healthcare authorities were researched at the first stage. The search of their URL addresses was accomplished using queries to the Google search engine. According to the criteria defined below the websites were tested for availability of information about the structure of a country's healthcare system and links to subordinate institutions, associations of physicians as well as special medical portals for searching physicians and hospitals. The possibility of

searching hospitals and physicians according to their specialization and the location of their practice and of the hospital, respectively, was also analyzed. If a government Web-resource gave such possibility, a transition to low-level authorities or hospitals and practices was accomplished using available web-links or by a query to an embedded search engine. Otherwise a search of special Web-portals (mainly public portals, if any) containing information about physicians and hospitals of a country was accomplished using a query to Google. A Web-portal such as these gives an opportunity of viewing not only necessary information about a specialist or hospital but also their rating according to patients' reports. To perform the analysis we chose twenty examples for each search category (physicians and hospitals) with the highest user rating. Each example had its own Web-resource. As a result a set of common and individual elements of the Web-resources inherent for each healthcare system was chosen. Web-resources with the completest set of elements for this category were presented as patterns in a table. It is worthwhile to say that a quality of the medical care provided by the respective facility was not considered. Based on the results of the table, a set of essential elements for designing the website structure of Russian municipal policlinics was selected.

Assessment criteria

Based on contemporary criteria of the assessment of Web-resources [10] a system of assessment criteria for each analyzed category was developed. Each system of criteria was classified into the following groups:

1. Content of a website:

General information about department of health (This highlights the need for users to know the necessary information about department's (and healthcare) history, structure, tasks, contact information, about available services).

National service frameworks and strategy (It highlights the need for users to know the necessary information about special welfare programs for different groups of citizens).

Health specific information (It highlights the need for users to know the necessary information about infections and vaccinations, diseases, their prevention, pharmacies and healthy lifestyle and health news).

Information about health laws.

Information about rights of patients.

Information about health insurance (national certificates).

Information about costs limits (It highlights the need for users to know the necessary information about costs limits for medical care services, established by legislation).

Information about healthcare hotlines.

2. Interactivity:

Links to related websites (Ability to pass by links to websites of the related authorities and institutions).

Search engines:

- Health A-Z (Ability to find information about disease by common condition, symptoms);

- Information, advice and support for anyone looking after someone else (Ability to use a "public bulletin board" with information about anyone looking after someone else for medical care);

- Search of a health insurance company;

- Search a job in healthcare system;
- National electronic referral service (Ability to find a medical treatment facility and book an appointment with a physician);
- Search and choose of a service (Ability to find General Practitioners, Emergencies and urgent care, Hospitals, Dentists, Pharmacies, Opticians by the set of search criteria).

Feedback:

- FAQ;
- Blogs of physicians;
- User comments on services;
- Questionnaire about website's quality.

3. Design:

Sitemap.

Languages.

4. Management:

Updates (Currency of information is nearly as important as information itself).

Privacy policy.

Quality account (It highlights the need for users to know the necessary information about used quality control system and its assessment criteria).

The assessment of the reliability of information posted on a Website is an important stage. For its implementation the HON (Health On the Net Foundation) code was used. This code is used for an assessment of reliability and ethics of medical information presented on the Internet [6, 13].

RESULTS

The developed set of criteria allowed us to carry out a comparative analysis of ways of providing e-services by healthcare institutions. It also allowed us to reveal advantages and disadvantages of the American, English and German healthcare Web-infrastructures.

United Kingdom

A Web-infrastructure existing in the UK is based on two government websites. The website of the Department of Health http://www.dh.gov.uk is focused on informing citizens about the current healthcare system. This website provides users with comprehensive information about:

- activity of the Department;
- its local subdivisions and trusts, including necessary contact information;
- current healthcare laws and welfare programs for different categories of citizens;
- preventive measures and treatment, vaccinations.

The website is supplied with video- and audio- sources. The feedback of the website allows users to express an opinion and to read opinions of other users according to different subjects; it is also possible to put a question to a consultant and to read answers in the section "Frequently Asked Questions" (FAQ). Navigation of the website allows users to realize the area search for

information, to pass to websites of the local authorities of the Department and other government institutions, some business and charity organizations. The main link is the link to the second basic government website of the National Health Services (NHS) http://www.nhs.uk. This website owns comprehensive functionality and provides users with information of all kinds about British healthcare system, laws and welfare programs, much like the previous website. The Web-portal of NHS is aimed to provide users with a variety of tools for searching medical treatment facilities according to the existing diseases (symptoms). One of the sections of the portal is devoted to an interaction of those who need home healthcare; the search of specialists is available here. There are also hot lines according to all sections of the Web-portal. The portal is supplied with two powerful search engines. The first search engine allows us to find diseases and relevant information about prevention and treatment according to the input data-symptoms; to receive a consultation about all relevant healthcare facilities via e-mail. The second search engine allows us to find a family or specialized physician, dentist or hospital, pharmacies according to their location, specialty or name. The result of the search is comprehensive information about:

- type of the activities;

- belonging to a trust (with the weblink to the Website of the trust);

- rating defined according to the reports of patients;

- location of the practice (or hospital);

- necessary contact information (mostly with weblinks to its Web-resource).

Both of the websites mentioned above have their own quality control system, allowing a holder of the website to monitor the opinion of users about the quality of provided services through results of the questionnaire.

As stated above specialized trusts are responsible for medical services provided in the UK. Each trust supervises a set of hospitals and practices of physicians. Therefore the design of the websites of hospitals belonging to the one trust is uniform; each of them has a logotype of the trust, weblinks to the websites of this trust and NHS. The Web-resources of a large part of hospitals give user comprehensive information about:

- activity of the hospital;

- the team of specialists;

- provided services;

- conditions of paid services provided and their payment;

- the days routine;

- conditions of preparation to the admission, hospital stay and discharge;

- information about concomitant diseases and their prevention;

- healthy life style.

Interactive facilities of the websites allow user to express an opinion and to read opinions of other users, to read answers in the section "Frequently Asked Questions" and to send a complaint via e-mail. For the registered users there is a service allowing them to read their own clinical records online. Due to the fact that NHS supervises activity of all public hospitals there is a system all over the UK for booking patients called "Choose and Book". This system allows users who are not in an emergency for care to choose a convenient hospital and book an appointment with a physician online, to lay out an admission to hospital and adjust it with a consultant of the medical treatment facility. The denoted services are available both on the website "Choose and Book" and on the websites of all hospitals registered in the system. Almost

all websites of the hospitals have a system of searching physicians (according to location of the practice, surname or specialization), who can continue to observe a patient after he is discharged.

The websites of private hospitals have their own design. The aim of the websites of private hospitals is to inform users about the activities of the hospital. Such websites are less interactive than their public analogues. Usually they do not allow patients to do anything online: there is no possibility to book an appointment with a physician online or e-mail and view clinical records. There are no also tools of quality control and services allowing user to express his opinion.

The analysis of the web-recourses of practices of general and specialized physicians showed that about 30% of them do not have their own websites. This is because comprehensive information about their activity is already presented on the website of NHS. At the same time almost all practices of dentists have a web-resource. Furthermore most of the practices of general and specialized physicians as well as dentists are public; they are also managed by trusts. Therefore interfaces, information content and functionality of the websites of practices belonging to the same trust are identical. Furthermore the case that several physicians with different specializations in one clinic (e.g. a university clinic) looking like a Russian policlinic work together is general in the UK. Functional possibilities of the websites of these clinics are similar to those of individual practices. Information content of the British websites of clinics and practices is characterized by comprehensive information about their activities. The information posted on these websites is similar to the one on the website of NHS. In general interactive facilities of the websites of clinics and practices allow users:

- to book an appointment with a physician online (a large part of practices work with overall information system of booking patients (EMIS); other practices can book a patient with e-mail request);

- to receive an online advise of the physician;

- to request a prescription via e-mail;

- to send a compliant (also via e-mail);

- to express an opinion about the practice and to read opinions of other users.

United States

The analysis of the American healthcare system showed that three government websites are the base of the Web-infrastructure. The websites of Government Healthcare (http://www.healthcare.gov) and US Department of Health & Human Services (http://www.hhs.gov) have the functional possibilities of the website of the British Health Department. Search facilities of physicians, hospitals and nurses are available at the government website Healthfinder (http://www.healthfinder.gov). All these websites are interrelated. Furthermore each website has a set of weblinks to the theme-based government websites and the websites of local healthcare authorities. The difference of the American system of searching physicians and hospitals is due to the absence of a government database. There are just links to the websites of associations of physicians and non-government specialized search engines. Such systems provide users with information like the web-portal of NHS. The difference consists just in additional information about license and education of the physician. Functional possibilities of the American websites of hospitals are comparable to the British analogues and do not depend on the form of ownership of the hospital. The difference consists in the absence of an overall system of booking patients. In general this makes it impossible to book patients online (sometimes it is even impossible to book an appointment with a physician via e-mail request) and viewing clinical records online. Half of the existing websites of the hospitals (irrespective to the form of ownership of the hospital) do not support the possibility of feedback with patients. Furthermore, in the US there are too few websites of family doctors (general practitioners), dentists and other specialists. Comprehensive information about them (contact and professional information,

ratings according to the patient reports) can be found on the websites of the associations or special web-portals. Also there are no such interactive facilities as booking an appointment with a physician online or via e-mail, requesting the prescription via e-mail and advising with a doctor online.

Germany

The infrastructure of German public healthcare web-resources is characterized by one government website of the Healthcare Ministry (Bundesministerium für Gesundheit (http://www.bundesgesundheitsministerium.de)) and a variety of websites of local healthcare authorities (all sites are interrelated by web links). The website of the Ministry of Healthcare in general provides users with information about healthcare laws. It does not support the possibility of searching hospitals and physicians and does not have web links to portals which would allow users to realize a search. Instead the function of searching hospitals and physicians is implemented on the non-government websites of the chamber of physicians called Bundesärztkammer, a self-administered public body, (http://www.bundesaerztekammer.de and http://www.patienten-information.de) and in a variety of private web-portals (e.g. Arztauskunft). Their functions are similar to the British and American portals of searching physicians and hospitals. The analysis of the websites of hospitals of all forms of ownership showed that their functional possibilities are similar to the websites of the American hospitals. Usually there is no possibility of feedback, interactive possibilities are restricted by filling in the special form of complaint (or request the admission to hospital) and sending it to the hospital via e-mail. In Germany it is necessary to post information about an existing system of service quality control on the website. Opposed to the US, in Germany there are websites of practices of general and specialized physicians. Furthermore like in the UK there are clinics with physicians of different specializations. The analysis of the practices of physicians of different kinds showed that only 30 % of the websites are interactive and allow users to book an appointment with a physician, receive a prescription or advice from the physician via e-mail. Generally websites are aimed to provide patients with information about the practice. Particularly there are many cases of posting information on a website, not only about forms of treatment but also about the step-by-step implementation of a treatment mode.

It should be emphasized that at all researched web-resources information about privacy policy and persons responsible for information content of a website was necessarily found. Furthermore the check of these websites with HON-code showed that all of them corresponded to it.

CONCLUSION

The analysis of the Web-infrastructures of the British, American and German healthcare systems showed that one of the most important factors of the degree of their development is the economic model of healthcare. Thus the public medicine with a budget finance system in the United Kingdom allows us to speak about a centralized model of the web-resources with clear interrelations between the web-resources of medical treatment facilities and well-developed interactive services:

- the overall public web-portal allowing users to search physicians and hospitals according to the existing symptoms, diseases, specialization and location of the physician or hospital;

- the overall public system "Choose and book", allowing users to book online an appointment with any public hospital;

- possibility of receiving a prescription via e-mail;

- possibility of viewing the clinical records online.

There are also feedback services, allowing a website designer to control the quality of the web-resource. As opposed to the public model with the budget finances, the other two models implemented in the US and Germany have no centralized management of the web-resources. This is partly caused by the absence of important interactive elements of the websites of medical treatment facilities (irrespective to their form of ownership). The important advantage of the German websites over the American and British analogues is their comprehensive information about forms and methods of treatment. One can notice that these German websites usually contain information about laboratories and laboratory engineering in practices. This allows users more easily to choose a medical treatment facility. Furthermore posting information on the website about the model, factors and perspectives of the development of quality of medical services is common for Germany. This gives a user an opportunity to assess the quality of medical treatment facilities not only according to the opinion of other patients but also according to the formal factors.

The same analysis of the Russian web-resources showed that the website of the Ministry of Health and Social Development of the Russian Federation is aimed to provide users with information about healthcare laws and social welfare programs. The analysis of web-portals of searching physicians and hospitals (public and private) showed that there was just contact information of medical treatment facilities. It was found that only a small part of hospitals has its own web-resources with information about types of activity, history of development and contacts. Moreover, all these hospitals were private. The same situation was observed for policlinics (clinics and consulting diagnostic centers). Only a few of them gave a user an opportunity to email to the registration office or to make an appointment with a physician online. The developing healthcare model based on principles of social insurance with primacy of public financing occurs in Russia, too. It is reasonable to assume that the British and German positive experience of the development of infrastructures of healthcare web-resources may be implemented for Russia.

The advantages denoted for the British and German infrastructures of the healthcare web-resources allowed us to reveal the group of elements, which are the possible base of the website of any Russian municipal policlinic (Table 2).

Obviously, designing the websites of public medical treatment facilities has to be implemented as a part of the overall conception. This will give an opportunity to develop interconnected and complementary websites providing users with comprehensive information about prevention and treatment of diseases, with the variety of e-services facilitating procedures of booking an appointment with a physician, referring patients to tests and an admission to a hospital and receiving a prescription. The development of interactive possibilities of web-resources directly depends on possibilities of information systems of medical treatment facilities.

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Table 2. The basic elements of the website of the Russian policlinic

Domain	Description
Content:	
Structure	Content of the website must provide user with a variety of information, giving the most complete notion about medical treatment facility. This must provide a patient before his 1st visit with necessary information about all physicians (ability to view records about physician's education, professional experience, scientific activity, surgery hours), available labor researches, types of treatment and using in this clinic treatment methods, ways of treatment (information about health insurance currently in force, conditions of free treatment, costs of payment treatment and additional services) and conditions of emergency care (including hot lines). These sections will allow patient to prepare to the 1st visit. Information about diseases, their prevention and life style will allow user to reduce a probability of appearance of any disease. The section with information about available vaccinations will allow patient to choose himself a policlinic, providing with this service.
Team	
Emergency care	
Labor researches	
Types of treatment and treatment methods	
Diseases, their prevention, life style and vaccinations	
Contact information	
Preparation to the 1st visit	
The daily routine	
Costs	
Health insurance	
Interactivity:	
Links to related websites	Ability to pass to websites of the related public (central and local) authorities, hospitals (municipal and regional) and healthcare insurance companies will allow user to learn necessary information about procedure of treatment.
Search and choose of a service	Ability to find practitioners by the symptoms and diseases within the policlinic; ability to find a labor.
Make an appointment via e-mail (special form) or online	It is necessary to post on the website the tool allowing patient to make the self registration using special forms and questionnaires (online or e-mail). This directly depends on a degree of the development of information support of the registration office of policlinic.
Viewing of medical records	It is necessary to post on the website a tool, allowing patient to view his medical records online. This directly depends on a degree of the development of information support of the registration office of policlinic.
Online consultation with specialists	Establishment of an online (or via e-mail) consultation with specialists of the policlinic will allow user to receive answers on organizational questions.
Repeat a prescription via e-mail with using of special form	Developing the e-template of prescription, its filling in and sending via e-mail will allow user to receive an easily readable document without home leaving.
Feedback:	
FAQ	Posting on a website this section will allow users to know necessary information without calling or sending e-mail to the policlinic.
Blogs	Blogs of physicians will provide user with an interactive communication with his physician.
User comments on services	This section will allow users to assess the quality of the services of policlinic by comments of other users.
Send a complaint via e-mail with using of special form	This is an additional tool of the system of services quality.
Questionnaire about website's quality	This will allow a website designer to control quality of e-services using opinion of users classified in objective criteria
Design:	
Logo and style	It is necessary to design the style of the website of policlinic according to the style of websites of the local authority and all hospitals subordinated to this authority. This will allow users to find any information comfortable and easily.
Sitemap	This tool is necessary for comfortable work of users with the sections of the website.
Languages	Information must be published on the official language.
Management:	
Updates	It suggest that currency of information is nearly as important as information itself.
Privacy policy	Privacy and security policy
Quality account	This highlights the need for user to know the necessary information about used quality control system, its assessment criteria and his role in the quality assessment.

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