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Improving Electronic Medical Records with Support of Human Computer Interaction in Medical Information Systems

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Abstract

This study investigated the most common challenges of human computer interaction (HCI) while using electronic medical records (EMR) based on the experience of a large Russian medical research center. The paper presents the results of testing DSS implemented in the mode of an additional interface with the EMR. The percentage of erroneous data for two groups of users (with and without notifications) is presented for the entire period of the experiment and the weekly dynamics of changes. The implementation of CDSS in the supplemented interface mode of the main MIS has had a positive effect in reducing user errors in the data. The results of the users survey are presented, showing a satisfactory evaluation of the implemented system. This study is part of a larger project to develop complex CDSS on cardiovascular disorders for medical research centers.

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1. Introduction

Recent years, so-called personalized medicine has become widespread and developed[1]. The transition to personalized medicine within the paradigm of P4 medicine (Predictive, Preventive, Participatory and Personalized)[2] is inextricably linked to the transition from evidence-based (or volume-based) medicine to value-based approach, which can be expressed as the ratio of the change in the quality of patient life and the number of resources spent on the treatment (the number of tests, procedures, prescription drugs, medical hours etc.)[3]. The most valuable is the care delivery, which is based on rigorous scientific knowledge and has the minimum cost with maximum benefit for patients. Costs are determined not so much by the monetary costs of treatment, as by the time and effort the patient spends on the treatment, and also by the quantity of man-hours. That is why, to provide the quality healthcare delivery, it is it is necessary to carry out comprehensive efforts that will reduce costs and improve the quality of treatment.

One of such area is improvement of human-computer interaction between physicians and medical information system. On the one hand, satisfaction with the system will allow physicians to enter more correctly and quickly all required information, and on the other hand it will improve the quality of the data itself for the purpose of their subsequent analysis.

The Western world invests significant resources to digitize healthcare with special emphasis on the creation of an integrated electronic medical records (EMR) to improve the efficiency and quality of care[4]. EMR offers several key advantages over paper medical records (PMR) related to quality of care, efficiency and high level of patient safety[5]. In addition, EMR is a valuable source of quality assurance of medical practice and research[6]. Effective use of EMR requires structured data entry; which can be a challenge for users due to EMR method of interaction, which does not coincide with their mental models and do not meet the requirements of document flow[6,7,8]. Poorly designed and cumbersome user interfaces of EMR input data can complicate the structured data-entry that will lead to a deterioration of data quality and incompleteness of data[9,10]. Consequently, this can lead to suboptimal functioning of information systems of medical technology, integrated into the EMR, for example, computerized support for making clinical decisions (CDSS). CDSS is one of the most effective strategies for improving clinical decisions[9,11]. CDSS often requires a large amount of data about the patient (demographic data, data on complaints, symptoms, medical history, physical examination, laboratory and other tests). Despite the fact that the researches aim is improving the quality of service, most of researches reported only about the improvement of the professional performance[11,12] and attempts to identify the critical success factors for CDSS systems have provided conflicting results[11]. System CDSS take their information from forms were filled in EMR and can provide inadequate advice due to incomplete and unstructured EMR data[13]. However, often application of the existing approaches to design DSS health care and medical is faced with significant difficulties for several reasons considered further with respect to Russian hospital practice. First of all, medical (clinical) information systems (MIS) in use often do not provide the functionality of DSS or the possibility to add such options. DSS deployment with existing MIS will complicate doctors' work because with filling paper records and entering data into MIS they will have to double the data in the CDSS.

Meanwhile, as mentioned above, improvement of human-computer interaction in EMR demands not only technical solutions, but also facilitation of physicians' understanding of the importance of such systems for their routine practice and further use of data stored in such systems.

2. Experiment description

The results of the current experiment are determined by previous studies. In particular, papers [14, 15] describe the analysis of data from MIS for the most common mistakes and it was suggested that the developing of a CDSS that integrates with an existing MIS can solve the problem. Authors of article[16] provide a general approach that was taken as the basis for the introduction of such a CDSS. As a result, an experimental sample of an integrated CDSS with a limited functional was developed and implemented for the current experiment (the CDSS architecture is shown in Fig. 1) The functionality of CDSS was intended to be limited for fixing errors and notifying users of a particular error. This was done to focus on the effect in the work and the perception of users from the operation of such a system.