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MASTER THESIS

EXAMINING THE EFFECTS OF INFORMATION SYSTEM INTRODUCTION ON THE SERVICES PROVIDED BY FAMILY PHYSICIANS AT THE HEALTH CENTER OF THE SARAJEVO CANTON

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AUTHORSHIP STATEMENT

The undersigned Esma Zlatar, a student at the University of Ljubljana, Faculty of Economics, (hereafter: FELU), author of this written final work of studies with the title Examining the Effects of Information System Introduction on the Services Provided by Family Physicians at the Health Center of the Sarajevo Canton, prepared under supervision of prof.dr. Maks Tajnikar.

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INTRODUCTION

As the information and communication technology has developed and pervaded our lives to a point at which it would be difficult to imagine our functioning everyday lives without it, we have grown accustomed to using numerous services intended to simplify our work and life and save us time. From using online banking services and making all types of purchases, to paying taxes and receiving various certificates and documents through e-Governance, the span of these services keeps widening, yet, one sector seems to lag behind all others – the health care sector. This is true in Bosnia and Herzegovina as well, where the introduction of information and communication technologies in the health care, namely, of one integrated system which would ensure smooth movement of patients through all levels of health care along with their data, has been talked about by the policy-makers for a long time, but has taken years to be put in practice. Moreover, no known surveys have been done to evaluate the use of this health information system among the health care staff.

Therefore, the purpose of this thesis is to analyze the recently introduced health information system in the Family Practice of the Health Center of the Sarajevo Canton (Bos. *Javna ustanova Dom zdravlja Kantona Sarajevo*), with the principal objectives of the thesis as follows:

- to present the health care information technology system at the Health Center of the Sarajevo Canton, specifically, the electronic health record and the prescription software within the Family Practice;
- to determine the extent to which the doctors use the system and to identify aspects of the system which warrant improvement and offer recommendations on overcoming the shortcomings;
- to explore the system's functionality and level of integration with other departments and other medical institutions within the Sarajevo Canton;
- to analyze the system's effects on workflow, processes and efficiency from the user's point of view, and to compare the processes prior to and post the information system introduction;
- to offer a glance into the future and possibilities for further development of the information system use within the primary health care in the Sarajevo Canton.

Based on the principal objectives of the thesis, the research questions are:

1. What are the major characteristics and elements of the health information system within the Family Practice of the Health Center of the Sarajevo Canton?
2. To which extent do doctors use the system?
3. How satisfied are the doctors with the system and its functions?

4. To what extent is the system integrated with other health departments and institutions within the Sarajevo Canton?
5. Does the system's use improve the doctors' work efficiency from their point of view?
6. What are the recommended future improvements to the system?

The research design of the thesis is a cross-sectional study which was conducted in the Family Medicine Department (Family Practice) at the Public Institution Health Center of the Sarajevo Canton. During the first step, the secondary data was gathered regarding the introduction of health information systems (hereinafter: HIS) in other countries as well as in Bosnia and Herzegovina, specifically the Sarajevo Canton, through literature review of published books, scientific articles, reports and conference proceedings on this topic.

The empirical part of the research for primary-data collection consisted of two phases. In the first phase, a semi-structured interview was conducted with one family physician at the Organizational Unit the Health Center "Centar" in order to gain the initial understanding of the system and software that were implemented in the Sarajevo Canton health institutions, more specifically the software that was being used in the Family Practice – the patient's electronic health record and the electronic drug-prescribing program. The second phase of the empirical research utilized the quantitative research methods by way of a survey conducted among the doctors working at the Family Practice of the Health Center. The survey questions were directly tied to the research objectives of the thesis. The total population size was 194 doctors working at the Family Practice of all nine organizational units of the Health Center, throughout the municipalities of the Sarajevo Canton (Javna ustanova Dom zdravlja Kantona Sarajevo, 2017b). Having in mind that there was a high probability that a certain number of doctors might not respond to the survey, no specific sampling technique was used, but rather, the survey was distributed to the total population. The survey was initially distributed in the printed form and sent in envelopes to head nurses within each of 9 organizational units of the Health Center. Subsequently, the electronic version of the survey was sent to e-mail addresses of the doctors who were the members of the Family Medicine Physicians' Association, with the request to take the survey only in the case they had not previously filled out the printed survey. The data obtained from the questionnaires was analyzed by descriptive statistics and presented. The non-parametric tests, the Kruskal-Wallis and Mann-Whitney U tests were used to test correlation between certain variables. When the analysis of the effects of information technology (hereinafter: IT) system on the workflow is concerned, the thesis utilized the principles of business process modeling and reengineering.

The Section 1 of the thesis gives insight into the history of the information systems in health care, different electronic health record solutions and effects of these electronic solutions on the workflow and business processes within an organization. The Section 2 offers overview of the introduction of health information systems in the health care in Bosnia and

Herzegovina, more specifically within the Family Practice of the Health Center of the Sarajevo Canton, and provides the review of some of its major characteristics. The Section 3 provides information on the methods of the primary data collection, as well as the results of the conducted survey among the Center's family doctors. The Section 4 further discusses the research results and offers recommendations for a more effective implementation of the system, while the final Section 5 offers a glance into the future possibilities, trends in the development of medical informatics and opportunities for advancement of the health information system in the Sarajevo Canton.

1 INFORMATION SYSTEMS IN HEALTH CARE

1.1 The History of Information Systems in Health Care

As in any field of academics and life, the informatics has opened up new horizons and led us to opportunities for efficiency and quality improvement which we never could have imagined existed. The invention of computers and development of terminology and research in the field of medical informatics from the middle of the 20th century onward (Collen, 1986), paved the way for advancements in computer hardware technology and software solutions which would ensure anything from better diagnostics and treatments for patients, enhanced digital data storage, retrieval and exchange, higher knowledge transfer and its dissemination, improved efficiency and the more adequate health policy design.

Today, a broad concept of "e-health" is frequently used to encompass aspects of information and communication technology contributions to the health care field, stated above. The World Health Organization (World Health Organization Regional Office for Europe, 2016, p.1) defined "e-health" as comprising many terms, such as:

- "electronic health records;
- mobile health, or m-health (e.g. apps, wearable technologies, medical devices);
- telehealth or telemedicine (whereby a patient can consult a health care worker on the computer, a tablet or a phone, for example);
- health-related e-learning (use of technology and media for training and educating both a broader audience and the health workforce);
- social media for health (informal, social online communication channels); and
- health data analysis and "big data" (transformation of data to provide insights and evidence for decision- and policy-making)".

Out of these, the **electronic health record** (hereinafter: EHR), is the most comprehensive and touted as the most important when implementing the IT health solutions throughout the world. The history of the EHR began with Lawrence Weed, who, in 1960s, realized that

physicians faced a contradictory task of handling each patient's case with much care and attention, while at the same facing a rapidly growing number of patients and enormous clusters of information concerning their health, specific and different for each and every case. He realized that there was a need for new standardization of patients' records and started working on a problem-oriented system (hereinafter: POMR), which would at least bring some organization into complexity that every doctor faced in their practice. In the course of 1970s, Weed led an effort to make an electronic POMR in order to ease retrieval of patient's information. He strove not only to organize patients' data, but also to use computers to help doctors in the clinical-decision process (Jacobs, 2009).

At about the same time, in 1972, the staff at Regenstreif Institute, Indianapolis, the United States of America (hereinafter: the USA), headed by Clement J. McDonald, developed the first EHR system – named the Regenstrief Medical Record System – and subsequent clinical trials proved how useful the system could be for managing patient information and improvement of care. But the system was not broadly accepted and implemented in the medical practices around the USA, exception being several state hospitals and innovation enthusiasts, probably due to high costs of computer hardware and software (Murray, 2014).

As Internet took hold in 1990s and the prices of technology rapidly decreased, the importance and advantages of using the computer and information technology in health care became apparent and less likely to be ignored. In 1991, the Institute of Medicine (hereinafter: IOM) in the USA issued a report with the data on a huge gap regarding information technology in the field of health care in the USA and recommended that every physician adopted the computer technology in order to improve the performance and communication quality (Institute of Medicine, 1991). In 2004, a stronger push towards the adoption of informatics in health care in the USA came with the formation of the Office of the National Coordinator for Health Information Technology (hereinafter: ONCHIT) within the U.S. Department of Health and Human Services (hereinafter: DHHS) and the President's call for the implementation of EHR solutions throughout the country (National Academy of Engineering & Institute of Medicine Committee on Engineering and the Health Care System, 2005).

However, while the attempt to bring computers into general practitioners' offices and ensure paperless work and access to networks did not produce satisfactory results in the USA, in other nations, such as the United Kingdom (hereinafter: UK), Australia, the Netherlands and others, computers were easily introduced into the primary health care level, both in the urban and rural settings. In the UK by 1996, nearly 96% of the general practitioners' offices were using computer and information technology and were connected to the NHSnet (Benson, 2002). In the Netherlands, 90% of the general practitioners had a computer in their offices in 1998 and around 60% of them used it for medical purposes (Knottnerus, 1999). In 2000, it was assessed that majority of doctors in general practice in Australia were using

computers in their clinical decision-making process (Kidd & Mazza, 2000). Following the suit, the developing nations also started turning towards e-health, and in 2009, the Croatian Ministry of Health, in collaboration with an IT firm, initiated the process of computerization of primary health care in 2003, fully implementing it by 2008 (Andrijašević, Angebrandt, & Kern, 2012).

During the 2010s, the use and proliferation of the IT systems in health care in countries throughout the world continued to increase, albeit with differences in the interoperability, extent of use, functionality and patients' ability to access their electronic health records. Since 2015, all insured persons in Germany have been issued the medical cards with the chip which stores all the basic personal and medical information about its holder. The legislation dating from the same year, the E-Health Act, determined the timeline, adherence incentives and penalties for doctors in order to insure they implemented and used the IT infrastructure and medical and insurance applications in the course of their work (Mossialos, Djordjevic, Osborn, & Sarnak, 2017). In China, almost all providers of medical services had their own electronic health record programs in 2016, which were sometimes linked to the health insurance institutions and firms, but were rarely integrated with the health systems of other providers, so patients had to take hard copies of their files in case they wished to or had to seek health care services with other providers. The patients, also, rarely had the possibility to access their records online or ask for a prescription or make an appointment. The situation was quite different in Denmark, whose doctors in General Practice in 2014 received the highest rating for their implementation of the EHR. All Danish citizens were issued the electronic identity document (hereinafter: ID) cards which could be used for various services in e-Government as well as in the health care. Different providers implemented different EHR solutions, but they were all interoperable since they all adhered to the national standards provided by the National Agency for Health IT (Mossialos at al., 2017).

As an example of the successful implementation of the IT solutions in health care, as well as in other fields, experts have frequently been citing the example of Estonia, touting it as "the world's most digitally advanced society" (Reynolds, 2016, p. 1). As early as 1997, Estonia introduced the e-Governance with an aim to reduce bureaucracy, simplify people's lives and save precious time. It was followed by issuance of electronic ID cards for all citizens in 2001, which hold all necessary personal data in an encrypted form and which enable the Estonians to prove their online identity and use all the services provided as a part of the e-tax, e-voting, e-passport, e-health and numerous other online services (E-Estonia, n.d.). The developments in the public IT sector were mainly possible due to the vision and determination of the governing structures in the country, which ensured that all the necessary legislation and infrastructure would back up these developments without lagging, and that it would be done so in a centralized manner – at the national level. As the great majority of the Estonian citizens' information is now digitalized, making it vulnerable to

inside and outside attacks, the protection of the data was declared of paramount importance, leading to invention of novel ways to hold and protect that data, making Estonia one of the world leaders in cyber security (Hammersley, 2017). The Estonian health care database is part of the comprehensive national database. In 2005, the national Estonian e-Health Foundation, whose task was to oversee and implement e-health solutions in Estonia, was formed by several actors, including governmental institutions, medical institutions, expert associations and unions (Estonian E-Health Foundation, n.d.). From 2008, all health care providers have been obliged to send patient's health data to the Estonian National Health Information System, with the Foundation setting standards in order to ensure the interoperability and equal format of the documents. Some of the most important characteristics of the Estonian e-Health system are that patients are owners of their medical data, they can read their health records online and track if somebody other than the persons they authorized is accessing their data. All providers are obliged to sign contracts with the Foundation, aware that all their activity within the system is tracked and logged and that in case of infringement, they can face legal action. The system was built and designed in a way to prevent even the IT staff from illegally accessing or changing patients' health data (E-Health: Estonian E-Health Foundation, n.d.).

The study by Parv, Kruus, Mõtte, and Ross (2016) reaffirmed that, indeed, the Estonian e-health system has been successful and has been accepted and widely used by different actors. The levels of satisfaction with the second-generation e-prescription software were high, but the authors pointed to the fact the system lacked a more precise evaluation of its effects on cost-efficiency and service quality, especially in the implementation phase.

1.2 The Literature Review

1.2.1 Characteristics of the Electronic Health Record Solutions

It has been stated previously that the central task in regard to using information technologies in the field of health care is the introduction and adoption of the patient's EHR at the primary level of a health care system. The importance of having a quality primary level health care for the general well-being of the population cannot be overemphasized. The primary-level doctors are at the frontlines of the health care system and function as gatekeepers. They can establish a special connection with their patients and their families, they have a great capacity to offer preventive services, to treat chronic diseases which present an enormous burden on a society and to act as early warners in cases of epidemics (Bates, Ebell, Gotlieb, Zapp, & Mullins, 2003). Introducing information and communication technologies in such a system can reap great benefits in terms of quality improvement of services, patient safety and reduction of prescription errors, statistics and epidemiology, policy design and adoption, cost and redundancy reduction, enhancement of communication

between medical workers and patients, as well as between medical workers themselves, etc. (Bates et al., 2003).

Several terms have been used when referring to forms similar to EHR, such as "computer-based patient record", "automated health record" and "electronic medical record", but they all vary in their structure, functions, connectivity and level of integration with other systems. Recently, the term "electronic health record" has been most frequently used in literature and, while there is no consensus on its definition, the World Health Organization (2006, p. 12) offered this simplistic definition: "The Electronic Health Record:

- Contains all personal health information belonging to an individual;
- Is entered and accessed electronically by healthcare providers over the person's lifetime; and
- Extends beyond acute inpatient situations including all ambulatory care settings at which the patient receives care".

There are 10 key functions which should be fundamental to each electronic health record software: laboratory order entry, laboratory test results, radiology order entry, radiology test results, electronic visit notes, reminders for care activities, electronic medication lists, electronic problem lists, transmission of prescriptions to pharmacies, electronic referrals (Simon et al., 2009). There are additional features to EHRs, such as the knowledge and clinical-decision support, but they require a more complex software and constant updating, and, despite their importance, are not included in the basic EHR package.

However, these functions, on their own, are not what makes a complete patient's electronic health record, it is rather the ability to ensure continuity in patient's care by having longitudinal EHRs which are capable of compiling all relevant patients' data throughout their lifetimes and over multiple providers. This can be ensured by establishing one overseeing agency/government body which would put in place standards for collecting and sharing of personal and health data, thereby providing for interoperability between the EHR users. In the USA, due to its huge area, as well as the differences between levels of government and local and state authorities, various EHR systems had been put in place by different software companies, with no previously set standards and with limited possibilities for hospitals and primary level practices to communicate patients' information among each other (Ford, Menachemi, Peterson, & Huerta, 2009). Therefore, the USA government began an initiative called "Meaningful use of EHR" (U.S. Department of Health & Human Services, 2015) to encourage both health care providers and companies to make and use standardized and certified EHR software and to use them in such a way as to: a) improve quality, safety, efficiency; b) engage patients & families; c) improve care coordination; d) improve public and population health; e) ensure privacy and security for personal health information. When the care of chronic patients is concerned, which makes for a large part of primary health care, EHR's basic functionality should have capacity to present patient's

longitudinal status concerning diseases and treatment, provide trend analysis and serve as a medium for communication with the patient, including sending reminders and education materials. Considering that the data of chronic patients tends to pile up fast, the system should enable filtering and provide clear and uncluttered display of data (Unertl, Weinger, Johnson, & Lorenzi, 2009). A horizontal scrolling banner in form of a timeline of patient's visits could be used in this case, for simpler presentation of data over time.

When the issue of adoption of EHR among the physicians is concerned, studies have shown that doctors and other staff can have concerns over financial costs of implementing such systems, of its efficiency and workflow disruptions, of system's quality and safety, as well as their liability due to the use of the system. To counteract these apprehensions and improve chances for successful adoption of EHR, the management should ensure leadership and vision during the implementation phase, standardization of terminology, provision of quality and detailed training and regular support, especially in the beginning and to the staff with no previous computer knowledge (Ludwick & Doucette, 2009). Boonstra and Broekhuis (2010) conducted a systematic review of studies on barriers of EHR adoption among physicians and concluded that the barriers fell in eight categories: a) financial, b) technical, c) time, d) psychological, e) social, f) legal, g) organizational, and h) change process. Other challenges concerning the implementation of a HIS in a healthcare environment included difficulties with engagement of clinicians, whose different levels of computer literacy and general motivation negatively impacted the EHR implementation within the English National Health Service (hereinafter: NHS). Also, due to the fact that the clinicians got used to high functionality of technology that they used at home and which made their lives easier, they also had higher expectations regarding what capabilities the IT equipment at work should provide for (Clarke et al., 2015).

While the physicians were apprehensive to how EHRs might affect their work, administrators, academics and policy-makers on the other hand had less negative views of the system, being aware of its disadvantages, but also having the vision of what such “big data” could produce in terms of a better research, disease control, policy design and deliverance of quality health care. “Big data” is not only seen as the very large data sets, but also as instruments and tools we use to explore and use those sets, as well as a completely novel way of thinking and research with drastically widened scale and depth (Boyd & Crawford, 2012). Nevertheless, as the policy-makers had high hopes for using the large amounts of information collected through the HIS, clinicians, such as those within the NHS, sometimes felt that such and similar policies were forced upon them by the government, without their clinical value and relevance being previously attested (Clarke et al., 2015).

Considering the sensitivity of personal and health data that is being inserted into the health information systems around the world, the protection of that data is of paramount importance for institutions introducing such systems, and it can present an additional burden

and responsibility. Kruse, Smith, Vanderlinden and Nealand (2017) placed the most frequent security measures for EHRs into three categories: a) administrative – such as procedures and policies for data security, risk management, safety evaluation, contingency plans etc., b) physical – limiting physical access to equipment only to the persons which have the authorization, and c) technical safeguards – limiting access through the system only to the authorized personel depending on their function within the health institution.

In the field of health care quality improvement, an important but complex addition to the basic EHR, named “clinical decision support” (hereinafter: CDS) has been touted as the most promising. In order to provide effective as well as efficient services, physicians should follow guidelines and standards provided by the evidence-based medicine. While individual physicians anecdotally reported that use of the EHRs in their practices led to faster and better access to patients' health information, better communication and reduction of medical errors, the presumption that use of EHRs improved quality of patient care was not proved in the study by Linder et al. (2007). Adding on Linder's work, Romano and Stafford (2011) investigated whether clinical decision support, as an additional feature to EHRs, might in turn raise the quality of health care services provided. However, their detailed study failed to prove that with CDS quality improved for more than for 1 out of 20 ambulatory care quality indicators. While they acknowledged that specific institutions showed that EHRs were more efficient than paper records, they emphasized that EHRs varied greatly in regard to their structure and functionality and that the institutions in the USA should examine why CDS benefits that had been shown in randomized controlled trials failed to translate into quality improvement at the national level.

1.2.2 The User Satisfaction

During the early years of the wider EHR implementation, physicians had high expectations from the newly introduced health information systems. A study done by Gamm et al. (1998) showed that the implemented program's utility was rated less favorably than its expected utility, and that the doctors were unsatisfied with the number of screens that had to be accessed and completed during the course of the patient's visit. Dansky et al. (1999) were interested in what could be done prior to the HIS implementation, and their research showed that physicians' satisfaction with the system depended on their previous computer experience, computer anxiety and level of organizational support.

In the same year, Sittig, Kuperman and Fiskio (1999) found out that in order to improve user's satisfaction with the system's interaction, the data on the computer screens should be arranged in a manner to display the most important information and help doctors make adequate decisions regarding the patient's care; that the terminology used should be known to the doctors; that the process of making corrections be simplified; and that the most frequent tasks be completed with the least number of steps. The users of EHR in primary

care also appreciated the remote access and messaging functions that enabled doctors to improve communication efficiency and information integration (Joos, Chen, Jirjis, & Johnson, 2006).

By 2009, the EHR providers in Norway (Christensen, Faxvaag, Lærum, & Grimsmo, 2009) managed to implement the systems which were user-friendly and which were widely adopted and highly integrated. Their colleagues in the Netherlands, however, realized that the challenge in designing of these systems was how to make a fully functional and integrated HIS with a simple interface and easy navigation throughout its content. The sheer amount of patient's data could easily prevent the doctors from gaining fast overview of patient's health issues. Therefore, M.W. Jaspers, W.P. Peute, Lauteslager, and J.M. Bakker (2008) concluded that the steps and processing of information by the HIS should completely correspond to the steps and processing of information during the course of the doctor's work, and that the minor changes to the interface screen and interaction structure could have major effects on the usability of the system. Poorly designed programs increase the mental workload of the physicians during the demanding and responsible work with patients, resulting in reduced user satisfaction and increased frustration on the part of the doctor (Peute, De Keizer, Van Der Zwan, & Jaspers, 2011). Therefore, the end users should be consulted in the process of the EHR design and subsequent redesign because their recommendations have the potential to transfer the actual workflows into the computer workflow, improve patient safety, reduce doctor burnout and increase their job satisfaction (Guo, Chen, & Mehta, 2017).

The 2012 survey done by the American Association of Family Physicians (Edsall & Adler, 2012) on of the EHR use among its members showed that the users were most satisfied with the messaging function, finding of data, the documenting process and e-prescription, while they were least satisfied with the EHR's effect on their productivity, its effect on their ability to concentrate on the patient care and the support provided by the EHR's provider. A research performed in six provinces and territories in Canada (Tharmalingam, Hagens, & Zelmer, 2016) indicated that the end users of the HIS' implemented there tended to view them in a positive manner, both in regard to the systems themselves and their effects on doctors' level of productivity and quality of patients' care. The analysis of the survey results suggested that the basis for the end-user satisfaction lay in the quality of the system itself, as well as in the quality of the service and support provided to the doctors during and following the implementation of the HIS. The systems that were rated negatively were rated so due to the aspects such as the poor technical support and training, negative impact on the productivity and quality of care, as well as the incompatibility with the business processes in their practices.

1.2.3 Business Processes and the Electronic Health Record

The introduction of information and communication technologies in the health care settings leads to numerous changes in the workplace which employees must get accustomed to and be ready to accept, workflow being one of them. Workflow is defined as a description of processes people follow to perform tasks, which in addition also contain aspects of how people interact with each other and with technological inventions to complete these tasks (Unertl, Weinger, & Johnson, 2006).

There is no single, agreed-upon definition of what a business process is. Davenport (1992) defined a business process as a set of activities with a structure aimed at producing a specified output, while Rummler and Brache (2012, p. 43) considered it as „the series of steps designed to produce a product or service." The Workflow Management Coalition (1999) broadened this definition, stating in its Glossary that these activities are realized in the context of organizational structure, thereby emphasizing the significance of relationships and interactions among the agents of these activities.

During the turn of the 19th and 20th centuries, when industrialization swept the Western world, the issue of how to organize work and its processes most efficiently grew ever more important. This question was first analyzed by Frederick Winslow Taylor (1856-1915), who was an engineer by profession, and who is today considered the father of scientific management. His most significant work – the book "The Principles of Scientific Management" has been translated into numerous languages and has had a great influence in all parts of the world (Giannantonio & Hurley-Hanson, 2011). The more practical implementation of similar ideas, especially the concept known as "Business Process Reengineering", we can find in Hammer (1990), Davenport (1992) and Hammer and Champy (2001). Their argument is that companies should endeavor, with the completely new vision and innovation, to redesign business processes in order to make them more efficient and thus, lead to expenditure cuts, better quality, reduction of redundancy and higher revenue (Bahramnejad, Sharafi, & Nabiollahi, 2015).

When an electronic patient health record is concerned, Ebell and Frame (2001) in their article "What can technology do to, and for, family medicine", presented the flow of information in primary care practice in terms of what an EHR program should encompass. They asked the following questions: a) does the program function well enough to record all data about the patient that is necessary (tests, medical and family history, examinations...); b) is the program integrated with other medical institutions at all levels of care; c) does the program provide help to doctors during the clinical decision-making process and offer possibilities for knowledge broadening, research and epidemiological decisions; and d) does the program enable efficient communication with patients and colleagues (Bates et al., 2003)?

In the qualitative study done by Grabenbauer et al. (2011), physicians had negative opinion on how EHRs influenced their workflow, at least in the initial phases, and were most concerned with how it impacted the communication with their patients during the collection of data in the course of the visit, and how much time it took them to click through the system in order to write down that data. While Bates, Boyle and Teich (1994) determined that it took significantly longer for physicians to make a computer-based physician order entry (hereinafter: CPOE) for e-prescription than to write prescription by hand, Overhage, Perkins, Tierney and McDonald (2001) determined that the CPOE speed improved over time. Moreover, a literature review on health information technology in primary health care (Tomasi, Facchini, & Maia, 2004) indicated that IT systems in health care were useful, specifically for improving efficiency in management processes.

Sometimes, the data and notes made by doctors can accumulate over time, making EHRs overflowing with data and making it difficult for doctors to find the information they need, especially in cases of chronic patients, with numerous comorbidities and prescribed drugs. The study by Lium, Tjora and Faxvaag (2008) pointed this out, emphasizing that there should be better options for filtering of data in EHRs and enhanced presentation of gathered patient information, recommending that as many information as possible be entered in EHR in a searchable form, keeping the scanning of documents to its minimum.

A qualitative study exploring the workflow at two Norwegian hospitals after the introduction of EHR (Lium et al., 2008) found that the employees were more satisfied with the system when the administration had firm stance on introducing IT and communicated that decision to the staff, alongside with including them in the process of implementation and ensuring that they had a good cooperation with the IT department and that their feedback on the quality and ease of use of the system was welcomed. The results of the study also indicated that employees preferred complete transfer to electronic records over keeping paper records parallel to the electronic ones, and that counselling with other hospitals on what works and what does not, prior to the introduction of the IT system, can reap great benefits and improve chances of successful implementation of EHR.

2 THE HEALTH INFORMATION SYSTEM IN THE SARAJEVO CANTON

2.1 Introduction of the Health Information Systems in Bosnia and Herzegovina

The implementation of interoperable IT health systems in a country is often part of its national strategy for provision of comprehensive e-services to citizens (e.g. e-government, e-tax, e-passport etc.) or runs simultaneously with it. In Bosnia and Herzegovina, the

Strategy for Public Administration Reform and its Action Plan were adopted by the highest instance of executive government – the Council of Ministers of Bosnia and Herzegovina in 2006 (Center for Policy and Governance, 2015). The Strategy, among other points, recognized the importance of making preconditions, both in the fields of legislation and capacity-building, for successful introduction of e-governance. In the same year, the Electronic Signature Law was passed.

However, due to the complex political situation in the country which consists of two entities – the Federation of Bosnia and Herzegovina and the Republic of Srpska, and the Brčko District, with the Federation further divided into 10 cantons (Agencija za statistiku Bosne i Hercegovine, 2016), so far there has been no consensus on the establishment of a national, over-seeing agency for control and accreditation of certification bodies for electronic signatures, and these legislative acts have not been implemented in their full capacity. The Action Plan was rewritten again in 2010, but even its implementation lags behind (Center for Policy and Governance, 2015). As a consequence, doctors' electronic opinions have no legal value, but they have to be printed out and signed by hand. The most recent development has been the B&H Council of Ministers' Decree on Adoption of Policy for Development of Information Society in Bosnia and Herzegovina for the period 2017 – 2021, in which the national Ministry of Communications and Transport of Bosnia and Herzegovina was named responsible for implementing the policy and reporting to the Council on annual basis (Politika razvoja informacionog društa Bosne i Hercegovine za period 2017 – 2021., 2017).

Parallel to this, the introduction of IT systems in health care has been slowly taking place in Bosnia and Herzegovina. Considering that the organization of health care is under authority of entity governments, health information systems have been implemented separately in its two entities: the Federation of Bosnia and Herzegovina and the Republic of Srpska. In its larger entity, the Federation of Bosnia and Herzegovina, the process of computerization of health care was first mentioned in 2005 (World Bank, 2005), as a part of the larger project of the restructuring of the health care system, with the focus on primary health care – named the Health Sector Enhancement Project (hereinafter: HSEP) – with the support of the Government of Japan. Its practical implementation began only much later, in 2012, as a part of the HSEP – Additional Funding Project, funded by the World Bank and co-financed by the Council of Europe Development Bank (hereinafter: CEB) and by the entity governments (Parlament Federacije Bosne i Hercegovine, 2012). It was agreed upon that the Federal Ministry of Health would head the project, while the implementation would be forwarded to the cantonal ministries of health.

In the Federation, medical documentation is regulated by the Federal Health Care Law, published in the Official Gazette of the Federation of B&H, no. 46/2010, and the Health Records Law (Zakon o evidencijama u oblasti zdravstva, 2012), published in the Official

Gazette of the Federation of B&H, no. 37/2012, which in the Article 38 states that the medical records are to be made both in the written and electronic form. This provision burdens, to a significant extent, already overstretched medical staff, requiring their additional time and patience, and introducing the risk of error.

In the entity of Republic of Srpska, the government adopted the E-Health Development Strategy for the period 2009 – 2014, in which one of the strategic goals was to "Establish electronic health record for every patient in Republic of Srpska and ensure flawless, secure, safe and timely exchange of health information among the providers [...]" (Ministarstvo zdravlja i socijalne zaštite Republike Srpske, 2010, p. 24). As of the end of 2013, most primary level health centers in this entity had been supplied by computers, internal networks, software for use in family medicine, training and an internet application. However, despite having centralized authority, the Health Ministry of Republic of Srpska has in practice discovered multiple problems and barriers to the successful implementation of this Strategy, some of them being lack of adequate hardware in all health institutions, installation of medical software which prevented exchange of information among the institutions, insufficient level of computer literacy among medical staff, etc. (Fond zdravstvenog osiguranja Republike Srpske, 2015).

2.2 The Health Center of the Sarajevo Canton

The Health Center of the Sarajevo Canton (Bos. *Javna ustanova Dom zdravlja Kantona Sarajevo*) is the largest public institution in Bosnia and Herzegovina providing primary and specialty-consultative health care services. It provides services to the population of 413,593 (Agencija za statistiku Bosne i Hercegovine, 2016) throughout nine municipalities within the Sarajevo Canton, the largest canton in the Federation of Bosnia and Herzegovina, as well as to the population from other cantons and countries, in accordance with the official agreements.

Within the medical sector, comprising 366 physician offices at 88 locations (Javna ustanova Dom zdravlja Kantona Sarajevo, 2017a), it has the following departments: Family Practice, Children Clinic, Diagnostic Laboratory, Radiology and Ultrasound, Physical Rehabilitation Center, Mental Health Center, Dental Clinic, Lung Clinic, Epidemiological Department, Internal Medicine with Diabetes Counseling Centers, Eye Clinic, Ear, Nose and Throat Clinic, and Neurological Clinic. In 2016, the Health Center of the Sarajevo Canton had 2074 employees, out of which 1623 were medical staff (550 doctors, 1063 nurses), who provided 11,272,185 services during 3,073,525 patient visits (Javna ustanova Dom zdravlja Kantona Sarajevo, 2017a).

2.3 The Family Practice of the Health Center

The Sarajevo Canton recognized the importance of family medicine and on the basis of the Federal Health Care Law dating from 1997 and the Cantonal Program for Organization of Family Practice in the Health Center of the Sarajevo Canton for the period 2003 – 2007, the Cantonal Assembly passed the Decree on the Family Medicine Clinics Network in the Health Center of the Sarajevo Canton, which provided that the Network include 84 family medicine clinics with the total of 212 family medicine teams throughout the Canton (Mreža ambulanti porodične/obiteljske medicine u JU Dom zdravlja Kantona Sarajevo, 2005). In order to bring about the reforms in the field of health care throughout the Federation of Bosnia and Herzegovina, the Federal Ministry of Health adopted the Strategy for Development of Primary Health Care in the Federation of B&H in 2006, followed by the Strategic Plan for the Health System Reform in 2008. The aims of the proposed reforms were the implementation of family practice system, which should enhance effectiveness and quality of health care services, as well as improve efficiency and reduce costs. The better quality of health care services provided by means of family practice was to be realized through ensuring continuity of health care, enhanced communication between patients, their families and doctors, improved coordination between the health care workers and easier movement of patients through the different levels of the health care system (Zavod za javno zdravstvo Federacije Bosne i Hercegovine, 2010).

The Family Practice department is the largest department within the Health Center, with 230 medical doctors, including specialists, and 321 nurses, providing preventive and curative health care services to the population older than 6, at 79 family medicine outpatient clinics throughout the Canton (Javna ustanova Dom zdravlja Kantona Sarajevo, 2017a). Its aim is to provide comprehensive, direct and continuous health care to families, including the acute and chronic disease management, systematic and control physical examinations, health education and counseling of patients, home visits and emergency care. In order to complete its mission, the Family Practice cooperates with other departments, such as the Diagnostic Laboratory, Radiology and Ultrasound Department, and it refers patients to specialty-consultative departments and other health institutions at the higher levels when the cases are out of its scope of work (Javna ustanova Dom zdravlja Kantona Sarajevo, n.d.).

In 2016, the Family Practice within the Health Center of the Sarajevo Canton had the total of 2,367,774 visits and provided services, often surpassing the adopted standards regarding the optimal daily number of patients in family practice. The number of active patient health records in Family Practice in 2016 was 359,044, with 315,914 registered patients (Javna ustanova Dom zdravlja Kantona Sarajevo, 2017a).

2.4 The Review of the Health Information System at the Family Practice of the Health Center

The introduction of information and communication technologies in health care in the Sarajevo Canton was initiated in 2006, when the Sarajevo Canton Assembly adopted the document named "Strategy of Information and Communication Technology Application in the Health Care of the Sarajevo Canton", which was in 2009 followed by the Action Plan for Implementation of the Strategy for the period 2009 – 2015 (Zavod zdravstvenog osiguranja Kantona Sarajevo, 2015). The funds from the HSEP – Additional Funding Project were used to purchase necessary hardware equipment for health institutions at all levels in the Federation (Federalno ministarstvo zdravstva, 2012).

In May 2013, the Health Insurance Institute of the Sarajevo Canton purchased through the international public procurement, notice no. 17-2-1-1-54/12 (Oglasnik javne nabavke, 2012), a medical information system and medical equipment from the company MedIT d.o.o. Sarajevo for 4.480.000 KM without VAT. This information system, whose basis was the patient's electronic health record, was intended for use in the largest primary health care level institution in the Canton – the Public Institution Health Center of the Sarajevo Canton (Oglasnik javne nabavke, 2013). Some of the main requirements in the procurement documentation concerning the health information system at the Family Practice of the Health Center were:

- the basis of the ambulatory information system (hereinafter: AIS) should be in the form of the electronic health record (EHR) containing the following patient's data: demographic information, type of health insurance, disease history, laboratory results, radiological images, cardiovascular devices reports, allergy and vaccination information, dental record, data on therapies, procedures, medicines, etc.;
- EHR should satisfy all needs for an optimal patient care in accordance with the open health standard platform – IHE – which promotes coordinated use of existing standards in this field, such as DICOM and HL7, and should have triple-layered architecture in accordance with the CEN prEn 12967 standard, known as the Healthcare Information Systems Architecture (hereinafter: HISA);
- e-referral: EHR should enable safe and secure electronic exchange of data between different health systems, departments and institutions within the Sarajevo Canton; it should especially provide for the complete synchronization of the system data (new and existing) and ensure two-way communication between the systems (sending orders from the Family Medicine Office to the existing laboratory information system (hereinafter: LIS), as well as to the Radiology's picture archiving communication system (hereinafter: PACS) and the Heart Station system and storing their images/reports in the patient's EHR;

- e-prescription;
- reporting and statistics;
- scheduling and changes to scheduling;
- drugs lists;
- disease coding according to the International Classification of Primary Care (hereinafter: ICPS-2) and International Classification of Diseases and Related Health Problems (hereinafter: ICD-10);
- all hardware and software forming the basis of the system should be centralized;
- all subjects in the primary health care information system should be connected through Virtual Private Networks (hereinafter: VPN) and the system should be available 24 hours, 365 days a year;
- every employee whose job requires access to the health information system must have a unique access code. The total number of system's users is to be 1200;
- education of end users with an instruction manual should be provided;
- logs: all data on users accessing the system, making changes and additions, including date and time of access/change should be logged;
- users should be given an option to make certain information confidential and patient data should be available to all departments, depending on the right of access;
- the system should support e-mail and fax communication within the system, as well as the short message service (hereinafter: SMS) outside of the system.

The timeline of the HIS introduction in the Health Center of the Sarajevo Canton is presented in the Figure 1:

Figure 1. Timeline of the HIS Introduction in the Health Center of the Sarajevo Canton

Year 2006

The Sarajevo Canton Assembly adopted a document "Strategy of Information Communication Technology Application in the Health Care of the Sarajevo Canton"

↓

2009

The Sarajevo Canton Assembly adopted a document "Action Plan for Implementation of the Strategy for the period 2009 – 2015"

↓

2012

Procurement notice for AIS and PACS in the Health Center of Sarajevo Canton published

↓

2013

Contract for the Health Center AIS and PACS signed (Contract no. 01-5676-UG/12 of 22 April 2013)

AIS and PACS implementation completed

eReferral within the Health Center activated

↓

2014

The Health Center of Sarajevo Canton and the University Clinical Center Sarajevo linked

Integrated EHR implemented

Central cloud for data exchange "EZOblak" created

↓

2015

ePrescription fully implemented with the three-month therapy

eReferral between health institutions implemented

↓

Activities yet to be implemented:

Centralization and complete integration of the Laboratory and LIS

Full adoption of patient's e-health cards

Integration of all health institutions and institutes in the Canton

Patient's portal design

Data security improvements

Financial modules' integration with the Cantonal Health Insurance Institute

Source: Zavod zdravstvenog osiguranja Kantona Sarajevo*, Izvještaj o radu za 2015. godinu Zavoda zdravstvenog osiguranja Kantona Sarajevo*, 2016, p. 13.

The Cantonal Ministry of Health named the Health Insurance Institute of the Sarajevo Canton as the authority for digitalization of the health care system and the owner of software licenses and all of data being entered into the integral health system on February, 18, 2014 (Zavod zdravstvenog osiguranja Kantona Sarajevo, 2015). In 2014, MedIT (*Svi timovi porodične medicine uvezani u sistem*, 2014) informed the management of the Health Center of the Sarajevo Canton that in the final phase of the project all family medicine teams at the Health Center had been linked to the system, with 500 computers and more than 165 printers and network connections in all family medicine clinics within the Canton. As a part of the project, MedIT implemented the EHR, electronic health insurance check, electronic protocols, partial electronic scheduling, as well as electronic referral and reporting, alongside with digitalization of the Radiology Department. The electronic health record program was named the "Ambulatory Information System" (AIS) while the e-prescription was set up as a separate program named "e-DOKTOR" (*Svi timovi porodične medicine uvezani u sistem*, 2014).

The Dental Clinic within the Health Center of the Sarajevo Canton was not integrated into the HIS because there were no funds for purchasing necessary hardware and network equipment. Also, out of 9 Center's organizational units, only EHRs in the units Health Center "Dom zdravlja Centar" and Health Center "Dom zdravlja Novi Grad" had complete integration with their laboratory information systems which were put in place and maintained by the firm "Wizard" from Mostar, Bosnia and Herzegovina, since additional financial resources were required to integrate the remaining centers and their laboratories (Zavod zdravstvenog osiguranja Kantona Sarajevo, 2015).

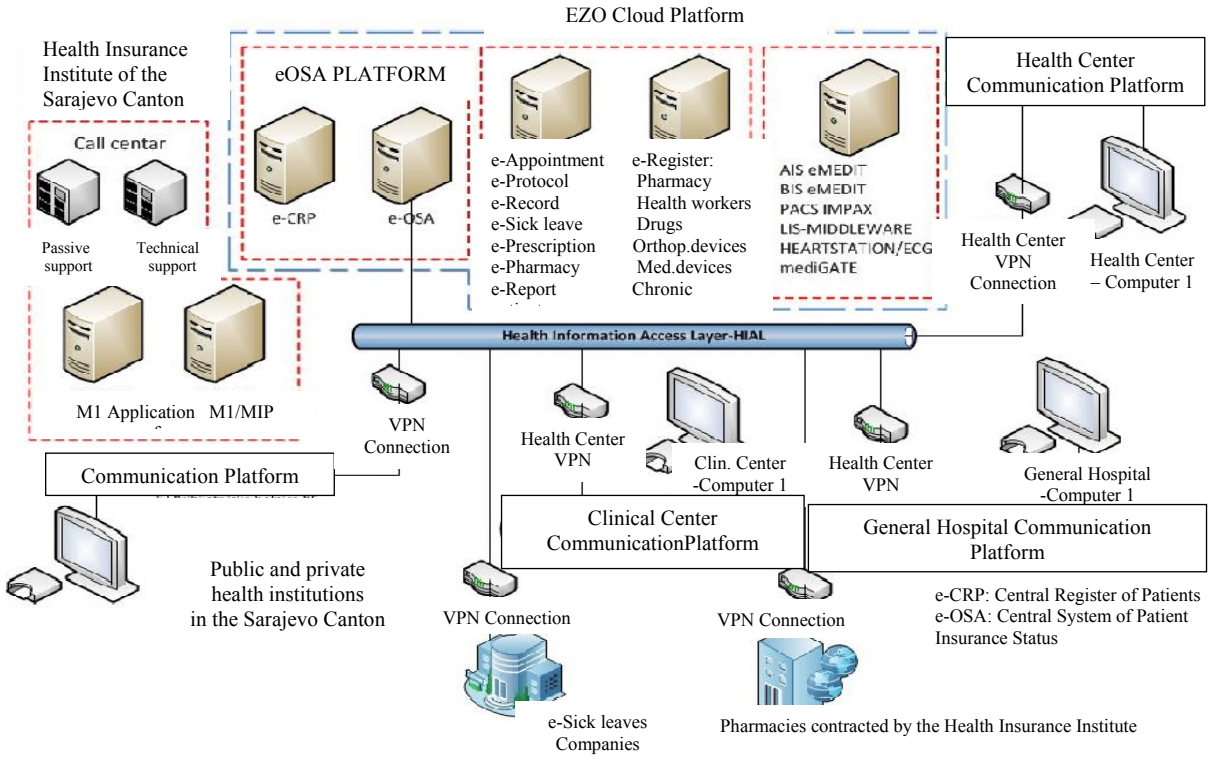
All pharmacies contracted by the Health Insurance Institute of the Sarajevo Canton were equipped with hardware and software and were linked in a single system in the course of 2014 and 2015 in order to ensure full implementation of the e-prescription project. The HIS was fully implemented at the General Hospital "prim.dr. Abdulah Nakaš" Sarajevo in 2015, and the Hospital was linked to other health institutions, pharmacies and the Insurance Institute. By 2016, the total of 18,571,642 KM was invested in the process of informatization of health care in the Sarajevo Canton, specifically for the procurement of hardware, software and digitalization devices (Zavod zdravstvenog osiguranja Kantona Sarajevo, 2016a).

The Health Insurance Institute of the Sarajevo Canton (2016) claimed that benefits of the implementation of IT in the health care were already visible during 2015, where in the case of the PACS system, all invested funds were returned due to savings made by application of electronic images in place of previously used radiology films in health institutions. Another benefit was the accessibility of patient's radiology and ultrasound images in several institutions anywhere in the Canton and their archiving within the patients' EHRs.

Moreover, the Institute stated, on the example of the Organizational Unit Health Center "Vogošća", that due to the introduction of e-prescription and option for three-month therapy, the number of patients, especially patients with chronic diseases, visiting physicians' offices fell significantly, leading to less workload for doctors and resulting, possibly, in better health care services provided (Zavod zdravstvenog osiguranja Kantona Sarajevo, 2016a).

The Figure 2 shows the architecture of the health information system implemented in the Sarajevo Canton.

Figure 2. HIS Architecture in the Sarajevo Canton

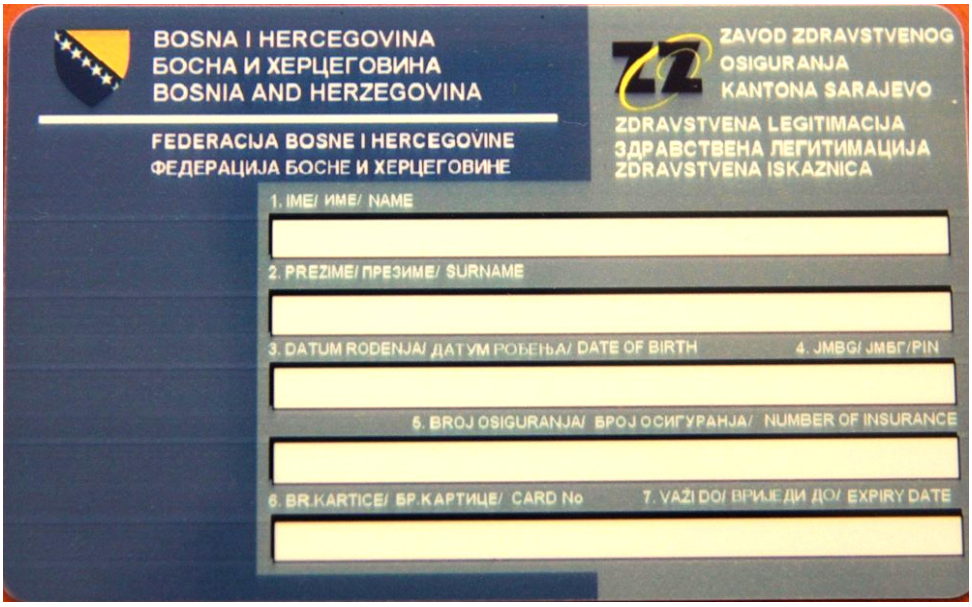


Source: Adapted from Zavod zdravstvenog osiguranja Kantona Sarajevo, *Izvještaj o radu za 2014. godinu Zavoda zdravstvenog osiguranja Kantona Sarajevo*, 2015, p. 16.

In order to simplify patients' path through different levels of the health system in the Canton and to ensure full use of the HIS, the electronic health card (Smart Health Card) was created (Figure 3). It was funded by the Sarajevo Canton, the Health Insurance Institute of the Sarajevo Canton and the World Bank. Unlike the paper health identity document (hereinafter: ID) card, health smart card had a microprocessor chip which could record and transfer data as needed, providing possibility for the better quality and safety of health care services, as well as the better and faster communication between health care providers. With this smart card, patients could carry their important health data everywhere with them. Another advantage was that patients would no longer need to validate their cards at the Institute's offices every three months to confirm that they were insured – the insurance

would be electronically checked and patients would be able to find that information on the internet. Security of patient's health data was of great importance, so the data were coded. They could be decoded only when both patient's card and doctor's professional card and personal identification number (hereinafter: PIN) were inserted into the reader, the exception being emergency cases, when doctor's PIN was sufficient to access patient's necessary health information. Every change of data on the card would be centralized and performed over the server with Central Authentication Service (hereinafter: CAS) (Univerzitetski klinički centar Sarajevo, 2013).

Figure 3. The Proposed Design of the New Smart Health Card in the Sarajevo Canton



Zavod zdravstvenog osiguranja Kantona Sarajevo (Bos.) – The Health Insurance Institute of the Sarajevo Canton
Zdravstvena legitimacija (Bos.) – The Smart Health Card

Source: Univerzitetski klinički centar Sarajevo, *Najvažnije o elektronskoj zdravstvenoj kartici*, 2013.

The Health Insurance Institute of the Sarajevo Canton in September of 2013 distributed an initial batch of 20,000 smart health cards to certain population categories such as persons with disabilities and retired individuals, followed by another 20,000 for the same population categories in July 2016 (Zavod zdravstvenog osiguranja Kantona Sarajevo, 2016b). Only in January 2017 did the Institute announce that additional 200,000 electronic health cards were being issued to insured citizens and that bar code readers would be distributed to clinics and departments throughout the Canton. However, it was soon noticed that a mistake had been made in the design of the card, specifically concerning the Sarajevo Canton's coat of arms, and the public was informed that issued cards would be withdrawn and new cards would be made and distributed at no additional cost to the insured within the Canton (Zavod zdravstvenog osiguranja Kantona Sarajevo, 2017), which has yet to take place.

The proposed benefits of IT advancements were numerous, however, it is still unclear to which extent this technology has been utilized at the Health Center of the Sarajevo Canton. Therefore, the purpose of this master thesis is to address this question by exploring the level of usage of the HIS and analyzing whether it is capable of answering the needs of professionals for a simple, comprehensive, useful and reliable system which would modernize the provision of health services to the population of the Sarajevo Canton.

3 RESEARCH RESULTS

3.1 The Interview and the Survey

The empirical part of the research for primary-data collection consisted of two phases. In the first phase, a semi-structured interview was conducted with one doctor, the family medicine specialist at the Organizational Unit the Health Center "Centar", in order to gain initial understanding of the IT system and software that was implemented in the health institutions in the Sarajevo Canton, more specifically the software that was used in the Family Practice – the patient's electronic health record and the electronic drug-prescribing program. This interview was used to gain general information about the structure of these programs, their functionality and integration from the point of view of a physician, with the possibility to see these programs first-hand, as well as to access some specific data on the application of the software within this environment and its effects on the practices of employees. This opportunity was also used to analyze the draft of the survey to be distributed among the family physicians working at the Health Center, and to discuss the possible adaptations to the survey with the physician.

The survey questions were initially formed on the basis of the conducted literature review and surveys such as: "End user computing satisfaction" (hereinafter: EUCS) (Aggelidis & Chatzoglou, 2012), "Post-Electronic Health Record Implementation: Survey of Providers" done as a part of the Primary Care Information Project (hereinafter: PCIP) in New York (New York City Department of Health and Mental Hygiene, 2005), and IBM's "Computer System Usability Questionnaire" (hereinafter: CSUQ) (Lewis, 1995). Following the interview with the aforementioned family physician, the survey questions were adapted to take into consideration the specific organization of the Family Practice, the health care sector in the Sarajevo Canton in general, as well as the structure of the implemented HIS in the Canton.

3.2 The Sociodemographic Data

The official data (Javna ustanova Dom zdravlja Kantona Sarajevo, 2017b) indicated that during the first three months of 2017, 224 doctors were employed at the Family Practice of

the Health Center of the Sarajevo Canton, however, due to various reasons such as long sick-leaves, specializations, long absences, etc., only 194 doctors were actually working. The total number of the Family Practice doctors who filled out the survey to a satisfactory level was 125. Partially filled-out surveys were discarded (n=5). For the confidence level of 95%, margin of error of 5%, the sample size should be 129 doctors.

The survey results showed that 104 respondents were female (83.2 %), while 20 were male (16 %), with 1 respondent giving no answer to the question of gender, as shown in the Table 1. The percentages indicated the dominance of women in the total number of family doctors at the Health Center of the Sarajevo Canton, which was in line with the official data (Javna ustanova Dom zdravlja Kantona Sarajevo, 2017c).

Table 1. Gender of the Respondents

		Frequency	Percent	Valid Percent	Frequency (official data)	Percent (official data)
Valid	Female	104	83.2	83.9	192	85.7
	Male	20	16.0	16.1	32	14.3
	Total	124	99.2	100.0	224	100.0
Missing	No response	1	.8			
Total		125	100.0			

Source: Javna ustanova Dom zdravlja Kantona Sarajevo*, Personalna karta,* 2017.

The mean age of respondents was 45.17, with the standard deviation of 11.018, ranging between the minimum of 25 and maximum 64, median being 43, indicting a rather old population of doctors in the Family Practice of the Health Center of the Sarajevo Canton (Table 2).

Table 2. Age of the Respondents

N	Valid	115
	Missing	10
Mean		45.17
Median		43.00
Std. Deviation		11.018
Minimum		25
Maximum		64

The Table 3 shows the distribution of doctors who filled out the survey depending on the organizational unit of the Health Center at which they worked. The health centers “Centar”, “Stari Grad”, “Novo Sarajevo” and “Novi Grad” belong to the four municipalities of the

City of Sarajevo, while the health centers “Ilidža”, “Vogošća”, “Ilijaš”, “Hadžići” and “Trnovo” belong to the municipalities surrounding the City. The official distribution data is also shown (Javna ustanova Dom zdravlja Kantona Sarajevo, 2017c).

Table 3. Distribution of Respondents across Organizational Units at Which They Worked

	Frequency	Percent	Frequency (official data)	Percent (official data)
HC “Centar”	23	18.4	36	16.1
HC “Hadžići”	10	8.0	14	6.3
HC “Ilidža”	24	19.2	30	13.3
HC “Ilijaš”	7	5.6	14	6.3
HC “Novi Grad”	22	17.6	56	25.0
HC “Novo Sarajevo”	7	5.6	33	14.7
HC “Stari Grad”	19	15.2	24	10.7
HC “Trnovo”	3	2.4	3	1.3
HC “Vogošća”	10	8.0	14	6.3
Total	125	100.0	224	100.0

Source*:* Javna ustanova Dom zdravlja Kantona Sarajevo*, Personalna karta,* 2017.

When asked about their profession, 44 % respondents marked their profession as “Medical Doctor”, 52.8 % as “Specialist”, while 3.2 % gave no answer, as shown in the Table 4. The survey percentages are in line with the official data (Javna ustanova Dom zdravlja Kantona Sarajevo, 2017c).

Table 4. Profession of the Respondents

		Frequency	Percent	Valid Percent	Frequency (official data)	Percent (official data)
Valid	Med. Doctor	55	44.0	45.5	103	46.0
	Specialist	66	52.8	54.5	121	54.0
	Total	121	96.8	100.0	224	100.0
Missing	No response	4	3.2			
Total		125	100.0			

Source: Javna ustanova Dom zdravlja Kantona Sarajevo*, Personalna karta,* 2017.

The structure of specialist doctors is presented in the Table 5, with the overwhelming majority of respondents who stated they were specialists, being Family Medicine Specialists (84.1 %).

Table 5. Structure of Specialist Doctors

		Frequency	Valid Percent
Valid	Family Medicine	53	84.1
	General Practice	5	7.9
	Occupational Medicine	3	4.8
	Emergency Medicine	1	1.6
	Clinical Pharmacology	1	1.6
	Total	63	100.0
	No response	3	

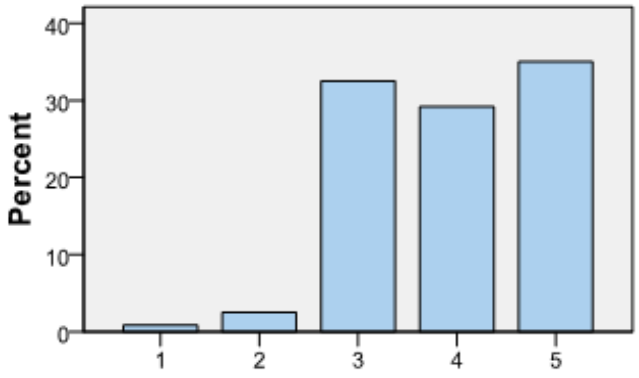
The self-reported computer literacy levels among the respondents were rather high (Table 6), with the highest number of doctors reporting their literacy on scale from 1 to 5, as 5 (35 %, *n*=42), as 3 (32.5 %, *n*=39), and as 4 (29.2 %, *n*=35), with the mean reported computer literacy of 3.95. Five respondents did not answer this question.

Table 6. Self-reported Computer Literacy

N	Valid	120
	Missing	5
Mean		3.95
Median		4.00
Mode		5

The Figure 4 shows the distribution of self-reported computer literacy levels among the Family Practice doctors.

Figure 4. Self-reported Computer Literacy



The mean reported length of experience in working with the health IT system at the Health Center of the Sarajevo Canton was 3.1 years with the standard deviation of 1,6537 (Table 7). Five respondents did not answer this question.

Table 7. Reported Length of Working with the HIS (years)

	N	Mean	Median	Mode	Std. Deviation
Valid N	120	3.00	3.00	3	1.6537
Missing	5				

The question "On average, how many patients a day do you see?" was answered by 120 out of 125 respondents, and results indicated that self-reported patient load per doctor was on average 41.56, with the standard deviation of 9.812, in the range between 2 and 62 patients per doctor per day, as shown in the Table 8. The official data of the Health Center on average daily number of patient visits per doctor per day stood at 32, which was lower than the self-reported load, but was still significantly above the planned workload by around 7 % (Javna ustanova Dom zdravlja Kantona Sarajevo, 2017b).

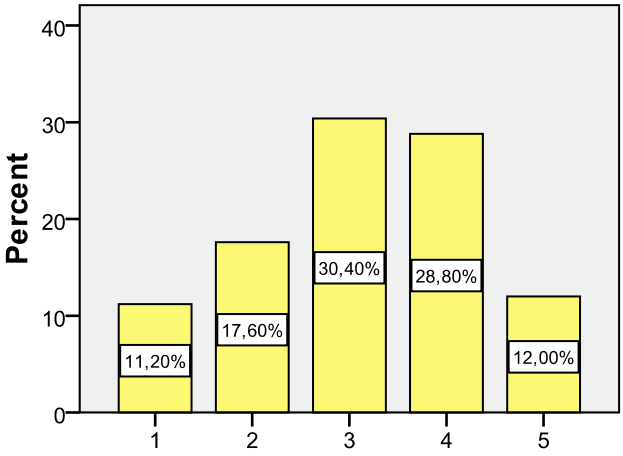
Table 8. Self-reported Daily Average Number of Patients per Doctor

N	Valid	120
	Missing	5
Mean		41.56
Median		40.00
Mode		40
Std. Deviation		9.812
Minimum		2
Maximum		62

3.3 Training

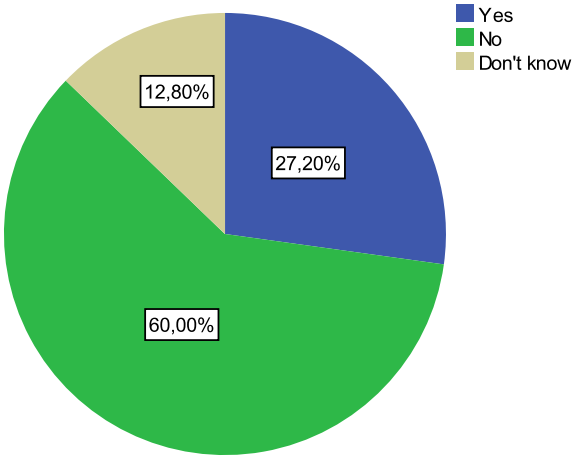
When the training on the use of EHR and e-prescription softwares is concerned, the respondents were only slightly satisfied, the mean rating of the training being 3.13. On the scale from 1 to 5, where 1 denoted „Very dissatisfied", 5 denoted „Very satisfied" and 3 being „Neutral", the majority of respondents rated the training with grades 3 (30.4 %, *n*=38) and 4 (28.8 %, *n*=36), as shown in the Figure 5.

Figure 5. Rating of the HIS Training



Although the requirement during the procurement of the HIS solution for the Health Center was that an instruction manual be provided to the end users, only 27.2 % (*n*=34) of respondents reported being provided with either an electronic or printed manual, while 60 % (*n*=75) reported not being provided with the manual and 12.8 % (*n*=16) reported not knowing whether the manual was provided or not (Figure 6). The data was troubling because it pointed either to the inconsistent provision of the manual by the provider or to the lack of information about the available manual on part of the doctors at the Health Center.

Figure 6. Reported Provision of the HIS User Manual



Out of 123 physicians who responded to the question whether they would like to have additional training on how to use the HIS, the slight majority, 59.3 % of respondents answered ”Yes”, in comparison to 40.7 % who refused further training. It would be of great significance for the Health Center management to identify employees who are interested in gaining more knowledge on how to fully use the HIS and to provide them with additional

training in order to improve the extent and intensity of the system's use, as well as enhance the quality and quantity of data inserted into the system.

3.4 Extent of Use

The reported extent of use of the EHR program by the doctors in the Family Practice was satisfactory, with the combined percentage of answers “I use daily” and “I use all the time” accounting for 83.2 % (*n*=104) of all the answers (Table 9).

Table 9. Self-reported Frequency of the EHR Use

		Frequency	Percent
Valid	Don't use at all	2	1.6
	Once in six months	4	3.2
	Monthly	7	5.6
	Weekly	8	6.4
	Daily	35	28.0
	All the time	69	55.2
	Total	125	100.0

For the electronic prescription program, the reported extent of use was even higher, with the combined percentage of answers “I use daily” and “I use all the time” accounting for 97.6 % (*n*=122) of all answers (Table 10). Such high adherence was probably due to the lack of code stickers for written prescriptions that the Health Insurance Institute of the Sarajevo Canton no longer provided in sufficient numbers to the doctors prescribers, as well as due to the fact that doctors used the program’s three-month-prescription feature more frequently.

Table 10. Self-reported Frequency of E-prescription Use

		Frequency	Percent
Valid	Monthly	3	2.4
	Daily	16	12.8
	All the time	106	84.8
	Total	125	100.0

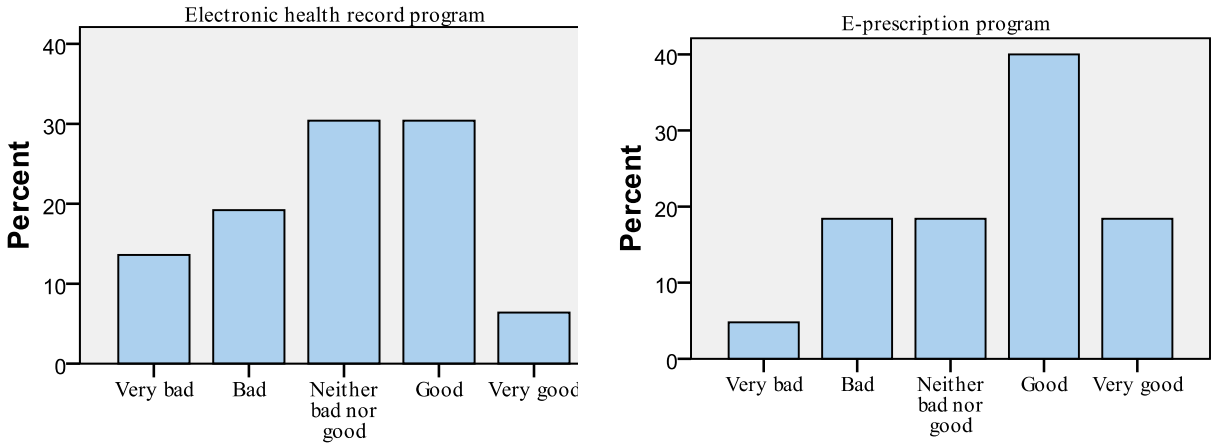
Following the recoding of the variables into groups, the Mann-Whitney and Kruskal Wallis tests showed no statistically significant difference ($p<0.05$) between the extent of the EHR use and the age or gender of the respondents, their level of education, the level of satisfaction with the training, the level of respondents’ computer literacy, or the average reported number of patients. However, there was statistically significant difference between

the extent of the e-prescription usage and the average reported number of patients, $\chi^2(4)=18.67$, p=0.001. Post hoc Mann-Whitney U test was used to analyze the difference between the groups and there was statistically significant difference ($p<0.05$) between groups 2 and 3, 2 and 4, 2 and 5; however after performing the Bonferroni Correction in order to prevent the type I error (p/10), only difference between groups 2 (between 20 and 29 patients a day) and 4 (between 40 and 49 patients a day) remained statistically significant at $p<0.005$, with U=153.0, p=0.000, and mean rank for group 2=19.25 and mean rank for group 4=32.17, indicating that the score for e-prescription frequency of use was higher for the group 4 where doctors reported more patients per day.

3.5 Rating of the Programs

The respondents rated the e-prescription program more favorably in comparison to the EHR program, with combined percentage for rating the e-prescription as "Good" and "Very good" amounting to 58.4 % (*n*=73), while the same percentage for EHR was 36.8 % (*n*=46). 13.6 % (*n*=17) of respondents rated EHR as "Very bad", while 4.8 % (*n*=6) gave the same rating for e-prescription, which can be seen in the Figure 7.

Figure 7. Juxtaposed General Rating of the EHR and E-prescription Programs



The Mann-Whitney test showed statistically significant difference between the rating of the programs and profession of the respondents. Statistics for the EHR program was U= 1039.5, p=0.000, and the higher score was given by the medical doctors (mean rank=75.1) than by the specialist doctors (mean rank 49.25), with the difference of r=-0.38. For the e-prescription, the results of the test were U=1172.5, p=0.000, and the higher score was also given by the medical doctors (mean rank=72.68) than by the specialist doctors (mean rank 51.27), with the difference of r=-0.32. The Table 11 and Table 12 further show the interesting distribution of the programs' ratings depending on whether the respondents were medical doctors or specialist doctors.

Table 11. Rating of the EHR by Medical Doctors vs. Specialist Doctors

	Very bad	Bad	Neither bad nor good	Good	Very good	Total
Medical Doctor	1	7	18	24	5	55
Specialist	15	16	19	14	2	66
Total	16	23	37	38	7	121

Table 12. Rating of the E-prescription by Medical Doctors vs. Specialist Doctors

	Very bad	Bad	Neither bad nor good	Good	Very good	Total
Medical Doctor	1	5	8	26	15	55
Specialist	5	17	13	24	7	66
Total	6	22	21	50	22	121

The Kruskal Wallis Test showed statistically significant difference ($p<0.05$) between how the respondents rated the training on the use of the programs and how they rated both the EHR and e-prescription programs, where for EHR the test results were $\chi^2(4)=58.7$, $p=0.000$, and for e-prescription $\chi^2(4)=42.79$, $p=0.000$. Post hoc Mann-Whitney U test was used to analyze the difference between the groups and, even after conducting the Bonferroni Correction, statistically significant difference ($p<0.005$) was found between the majority of groups, consistently indicating through mean ranks that the doctors who gave higher ratings to the training they had received on how to use the EHR and e-prescription programs, also gave higher ratings to the programs themselves. No statistically significant difference was found for the levels of the computer literacy or the age of the respondents.

When rating of the specific aspects of the programs was concerned, where 1 indicated the lowest grade and 5 the highest, total score was somewhat below average – the mean of all means was 2.63. The respondents gave the highest rating to the programs' appearance/visual design (mean 3.04, SD 1.180), and finding of desired patient's data (mean 2.87, SD 1.218), while they gave the lowest rating to the capability of making changes/corrections (mean 2.17, SD 1.037), followed by the speed of the system's response (mean 2.50, SD 1.133), as shown in the Table 13.

Table 13. Respondents' Rating of Different Aspects of the Programs

	N	Minimum	Maximum	Mean	Std. Deviation
Appearance/visual design	125	1	5	3.04	1.180
Speed of the system's response	125	1	5	2.50	1.133
Logic of field and function display	125	1	5	2.75	1.075
Level of integration of EHR and e-prescription programs	125	1	5	2.56	1.095
Finding desired patient's data	125	1	5	2.87	1.218
Speed of performing routine tasks in the program	125	1	5	2.58	1.072
Making changes/corrections	125	1	5	2.17	1.037
Programs' functions	125	1	5	2.60	1.070
Valid N (listwise)	125				
Total				2.63	

The respondents also rated various segments of the programs in regard to the simplicity of use and interface clarity (Table 14), where the total score was somewhat above the average – mean of all means was 3.19. The highest score was given to the patient's chronic diseases segment (mean 3.44, SD 0.971) and the electronic drug prescription (mean 3.44, SD 1.146), while the lowest score was given to the program's capacity to generate reports (mean 2.49, SD 1.229). Although the function "Reports" was provided within the HIS and detailed reports could be made by making request to MedIT, the survey results showed that the doctors were dissatisfied with the reporting capacity of the programs, which might also point to the lack of their familiarity with this function.

There was no available information on whether the relevant Ministry of Health or public health and health insurance institutes use the aggregated data collected from the EHR and e-prescription programs for policy design, other than the reports from the Cantonal Health Insurance Institute which tracked the spending on medications and drug prescriptions per doctor. Due to the fact that the EHR was not used in its full capacity by doctors and that because of the lack of time the data entered into EHR was insufficient, it was questionable to which extent the aggregated "big data" could be utilized at all. If this data is to become useful for managerial and policy-design purposes, there has to be a determined action on part of legislative and executive bodies, as well as the health institutions managements, to remove the paper health records from use and ensure that the introduced HIS is fast and intuitive for use in the Family Practice, where the doctors are overwhelmed with the number of patients every day.

Table 14. Respondents' Rating of Simplicity of Use and Interface Clarity for Various HIS Segments

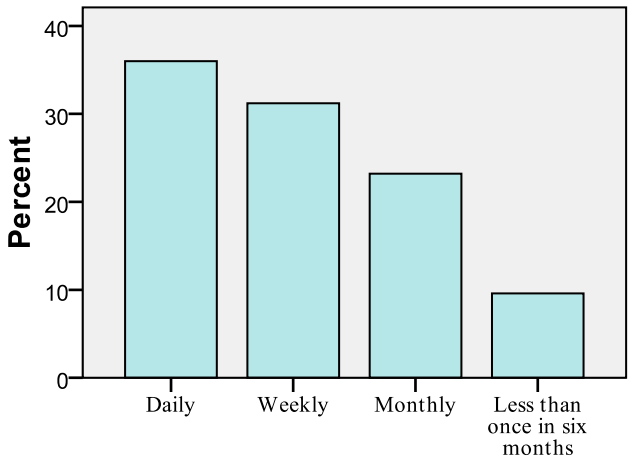
	N	Minimum	Maximum	Mean	Std. Deviation
General patient data	125	1	5	3.41	1.001
Patient's acute diseases	125	1	5	3.22	.999
Patient's chronic diseases	125	1	5	3.44	.971
Patient's medication	125	1	5	3.12	1.168
Referrals	125	1	5	3.08	1.119
Drug prescriptions	125	1	5	3.44	1.146
Info from other institutions	125	1	5	3.30	.961
Making reports	125	1	5	2.49	1.229
Valid N (listwise)	125				
Total				3.19	

In order to investigate to what extent the doctors were familiar with the EHR program and its functions, they were asked to rate their familiarity on the scale from “I am completely unfamiliar with the functions” to “I am completely familiar with the functions”. The majority of doctors (*n*=64, 51.2 %) claimed that they were “Familiar with the majority of functions”, followed by a third of doctors (*n*=42, 33.6 %) claiming they “Know the basic functions” and 11.2 % (*n*=14) saying that they were “Familiar with all the functions”. The results pointed to the fact that a large number of doctors could benefit from additional training in order to use the program’s functions to their full capacity.

3.6 Work Efficiency and Intensity

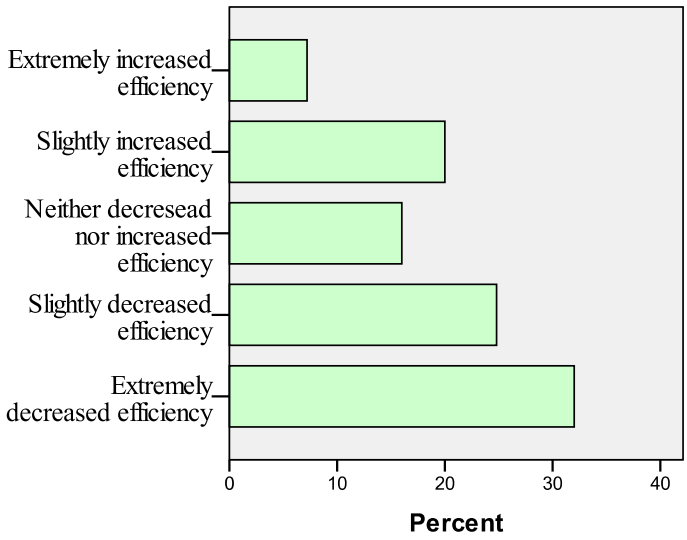
A significant percentage of family doctors (*n*=42, 38.5 %) reported facing problems with the system’s connectivity and downtime on the daily basis, while somewhat smaller percentage (*n*=34, 31.2 %) reported this challenge taking place weekly, as seen in the Figure 8. Problems with connectivity and program’s speed can seriously hamper doctor’s work efficiency, negatively affecting their satisfaction with the IT system and its subsequent use, possibly creating problems with the patients who might be prevented from receiving the timely medical service in case of the system downtime.

Figure 8. Frequency of Experiencing Connection Problems and Downtime



When the doctors were asked to which extent the EHR program use affected their work efficiency, it was indicative that its use had a negative effect (Figure 9), with the highest percentage of doctors reporting it „Extremely decreased their efficiency“ (*n*=40, 32 %), with the similar percentages of doctors reporting that it „Slightly decreased efficiency“ (*n*=31, 24.8 %) and „Slightly increased efficiency“ (*n*=25, 20 %). The combined percentage of doctors reporting decrease in efficiency (answers „Extremely decreased efficiency“ and „Slightly decreased efficiency“) stood at 56.8 % (*n*=71), while the combined percentage of doctors reporting increase in efficiency (answers „Extremely increased efficiency“ and „Slightly increased efficiency“) was 27.2 % (*n*=34).

Figure 9. Reported Effect on Work Efficiency after One Month of EHR Use



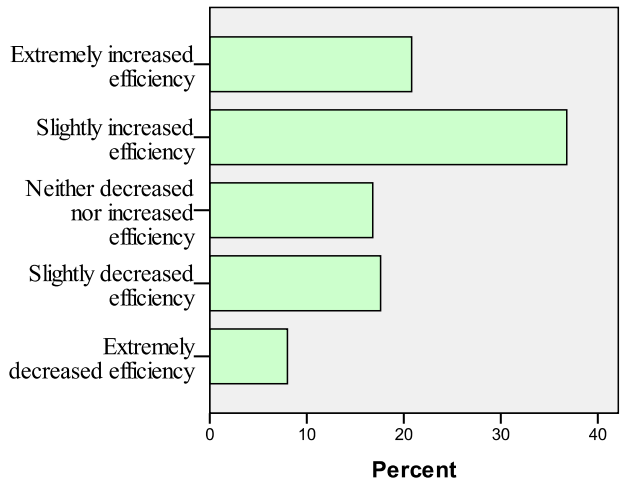
There was a statistically significant difference ($p<0.05$), shown by the Kruskal Wallis Test, between how the respondents rated the training on the use of the programs and how they rated the amount of EHR's effect on their work efficiency, with $\chi^2(4)=37.53$, $p=0.000$. Post

hoc Mann-Whitney U test was used to analyze the difference between the groups and, even after conducting the Bonferroni Correction, statistically significant difference ($p<0.005$) was found between the majority of groups, consistently indicating through mean ranks that the doctors who gave higher ratings to the training on how to use the EHR programs, also gave a more positive score to how the EHR affected their work efficiency.

The difference was also statistically significant between the rating of the EHR's effect on work efficiency and whether either electronic or paper user manual was provided to the doctors, with $\chi^2(2)=11.6$, $p=0.003$. Doctors who stated they had not been provided with a manual were placed into group 1, those that stated they had received a manual were group 2, and those who did not know were placed into group 3. Post hoc Mann-Whitney U test used to analyze the difference between the groups revealed that there was significant difference between the groups 1 and 2 ($U=852.5$, $p=0.004$; mean rank 1=49.37, mean rank 2=67.43) and between the groups 1 and 3 ($U=369.0$, $p=0.012$; mean rank 1=42.92, mean rank 3=60.44), indicating that the doctors who either received the user manual or were not sure, ranked the EHR's effect on efficiency higher.

In comparison to the EHR, the situation was different in regard to the effect of e-prescription software on the doctors' work efficiency (Figure 10). In this case, the highest percentage of doctors reported that the program „Slightly increased efficiency" (*n*=46, 36.8 %), followed by „Extremely increased efficiency" (*n*=26, 20.8%). The combined percentage of doctors reporting increase in efficiency (answers „Extremely increased efficiency" and „Slightly increased efficiency") was 57.6 % (*n*=72), while the combined percentage of doctors reporting decrease in efficiency (answers „Extremely decreased efficiency" and „Slightly decreased efficiency") was 25.6 % (*n*=32).

Figure 10. Reported Effect on Work Efficiency after One Month of E-prescription Use

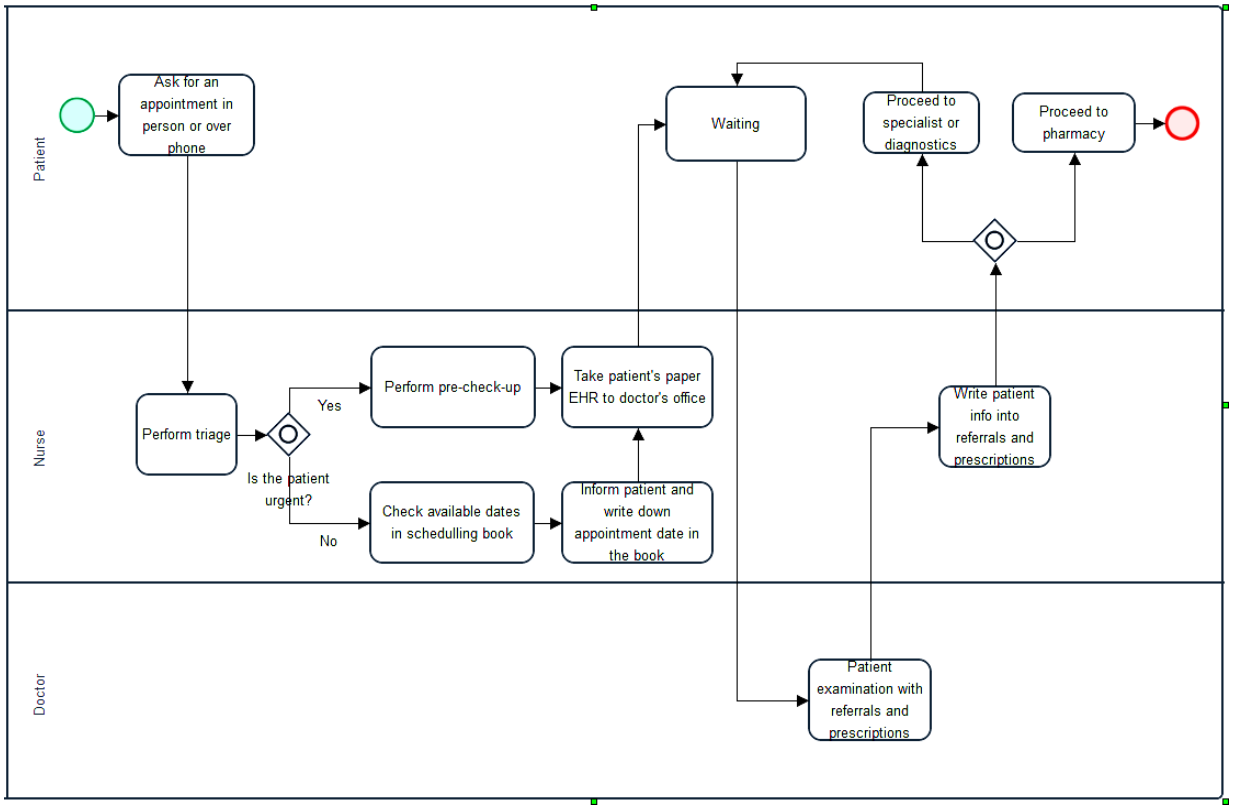


The statistically significant difference ($p<0.05$), shown by the Kruskal Wallis Test, was noticed between the rating of the e-prescription effect on work efficiency and whether either

electronic or paper user manual was provided to the doctors, with $\chi^2(2)=9.502$, $p=0.009$. Post hoc Mann-Whitney U test revealed the significant difference between the groups 1 and 2 ($U=812.0$, $p=0.002$), indicating that the doctors who received a user manual tended to give a higher rating to the e-prescription's effect on their work efficiency (mean rank 1=48.83, mean rank 2=68.62). The self-reported computer literacy and self-reported average patient load had no effect on how the respondents rated the EHR's or e-prescription's effect on work efficiency.

When analyzing the business processes of providing the health care services to patients at the Family Practice of the Health Center of the Sarajevo Canton, it was evident that there were several processes which could be partially or completely automated. The Figure 11 depicts the business processes in Family Practice prior to the introduction of the HIS.

Figure 11. The Heath Care Provision Business Processes in the Family Practice prior to the Introduction of the HIS

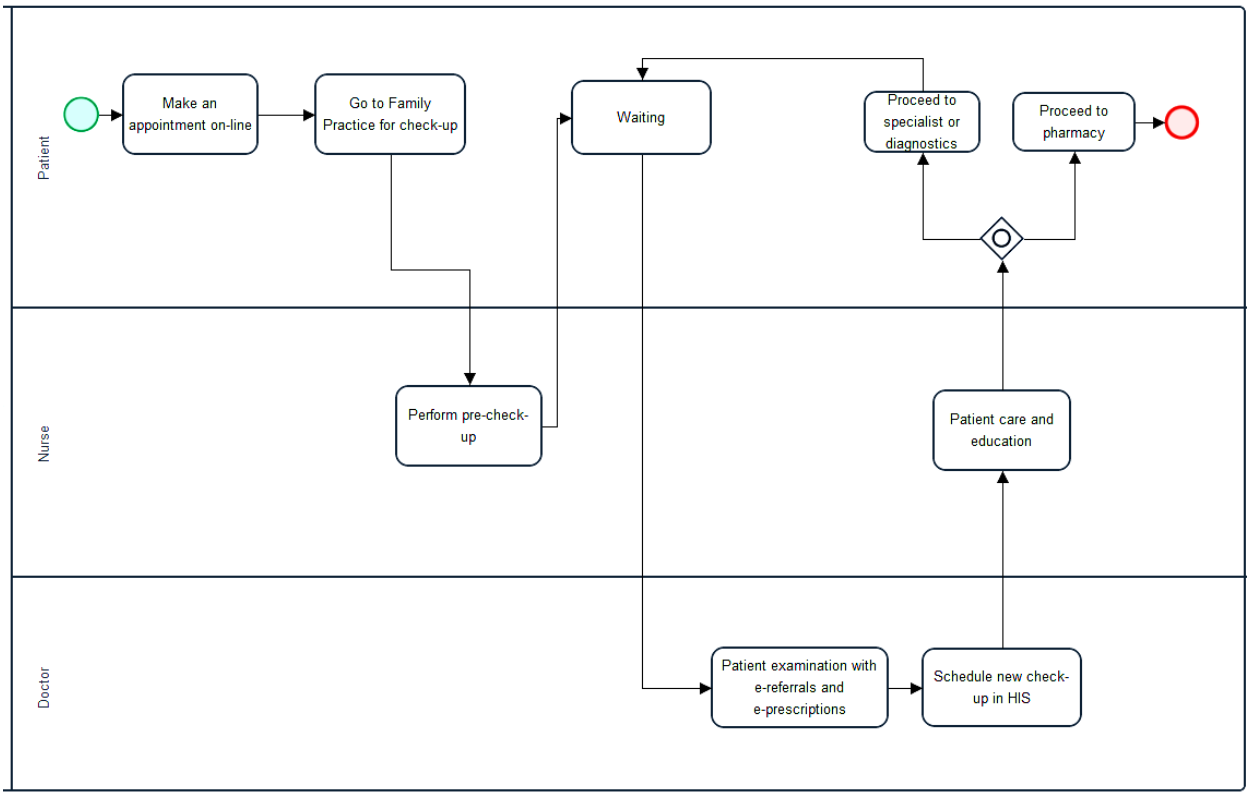


The tasks and time spent on administrative work could be greatly reduced when the work of nurses was concerned. The nurses spent a great deal of their time on answering phone calls from patients asking for appointments, checking the appointment book, taking the patients' paper records to and from the doctors' offices and placing them in their designated drawers, writing by hand necessary patients' data on the paper referrals and prescriptions, etc. All of this took a lot of time away from the main job of a nurse – to collect data on patient's health, to preform pre-check-up of the patient or to educate the patient and spend more time on

preventive services. With electronic scheduling and full implementation of EHR, e-prescription and e-referral, the nurses could devote more time to the important tasks. However, due to numerous necessary clicks through the HIS and the transfer of certain functions onto the doctors, such as making electronic appointments for the patient at the specialty-consultative departments, the HIS introduction might not have improved the efficiency of the doctors' work, especially in the initial phases at which the doctors must devote a lot of their time to learning and practicing the use of the programs. Therefore, as IT systems in health care become ubiquitous, there should be consideration of what tasks could nurses take on over from the doctors concerning the provision of health care services to the patients.

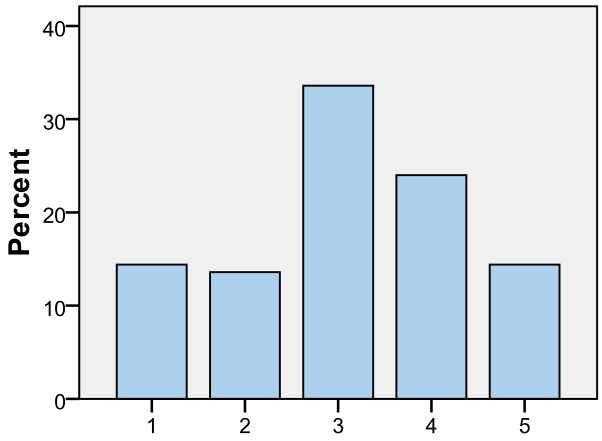
The Figure 12 depicts the major business processes in Family Medicine following the hypothetical successful and full implementation of a HIS, indicating the reductions on administrative work for nurses. Having in mind that the doctors at the Health Center were obliged by law to fill in patient's data in the paper records, while they were encouraged to fill it in the EHRs as well, it was obvious that savings in terms of paperwork were only slight. This obligation has created almost double work for the doctors and until this problem is resolved, the possible positive effect of HIS introduction on the efficiency of the doctor's work will not be fully realized.

Figure 12. The Hypothetical Health Care Provision Business Processes in the Family Practice Following Full Implementation of the HIS



The doctors reported only moderate reduction in the patient load following the use of the three-month e-prescription function, with the mean rating being 3.1 and mode 3, on the scale from 1 to 5, as shown in the Figure 13.

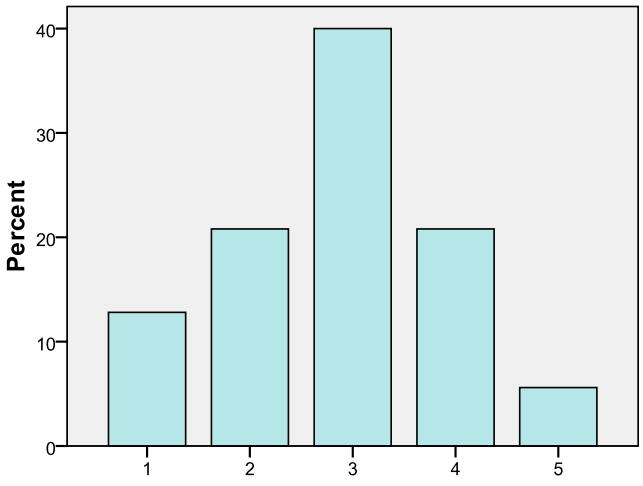
Figure 13. Reported Reduction in Patient Load after Using the Electronic Three-month-prescription Function



3.7 Work Quality

When considering the quality of patient data that they entered into the EHRs, on the scale from 1 to 5, the doctors rated it as mediocre, with the mean rating of 2.86 (*N*=125) and the mode of 3, as presented in the Figure 14.

Figure 14. Rating of Quality of Patient Data Entered into EHRs by Doctors



The Kruskal Wallis Test showed no statistically significant difference between the doctors' rating of their computer literacy or their reported daily patient load and how they rated the quality of patient data that they entered into the EHRs.

The majority of doctors (*n*=67, 53.6 %) stated that one of the side-effects of the HIS introduction, namely, the necessity to face the computer screen for prolonged periods of time, affected the quality of their relationship with the patient but not significantly, while 31.2 % (*n*=39) stated that it affected the relationship significantly. Only 12.0 % (*n*=15) were of the opinion that prolonged screen time did not affect the quality of their relationship with their patients at all (Table 15).

Table 15. Doctors' Opinions on whether Looking at the Computer Monitor during the Patient's Visit Negatively Affects the Quality of Their Relationship with the Patient

		Frequency	Percent
Valid	It affects significantly	39	31.2
	It affects, but not significantly	67	53.6
	It doesn't affect negatively	15	12.0
	I don't know	4	3.2
	Total	125	100.0

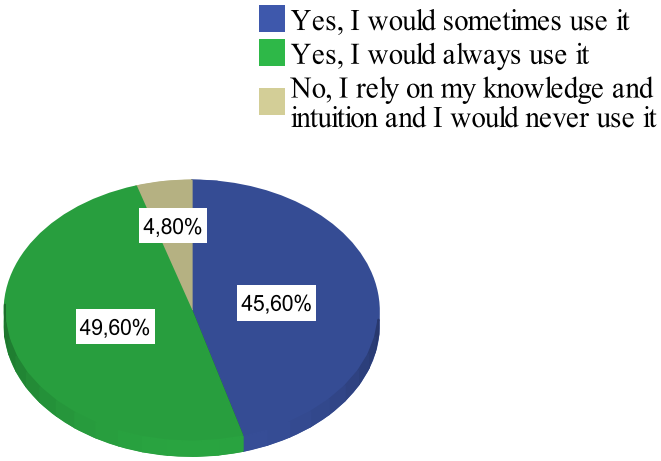
When doctors were asked to what extent they agreed to certain statements regarding the HIS (Table 16), the majority, namely 58.4 % (*n*=73) combined stated that they "Completely disagreed" and "Somewhat disagreed" regarding whether the system allowed them to access patient's data outside of the office, with only 20.8 % of doctors (*n*=26) answering that they "Somewhat agreed" and 5.6 % (*n*=7) that they "Completely agreed", raising the question of whether the doctors were aware at all of the capability to access their patients' data outside of their office, especially in case of an emergency. Concerning the statement that the system had helped improve preventive care of the patients, 40.8 % (*n*=51) stated that they "Completely disagreed" with 17.6 % (*n*=22) saying they "Somewhat disagreed". On the other hand, only 22.4 % (*n*=28) said that they "Somewhat agreed", with none saying that they "Completely agreed". The doctors' outlook was somewhat more positive regarding the statement that the system enabled a more quality care of chronic patients, where 36.8 % (*n*=46) said they "Somewhat agreed" and 4.8 % (*n*=6) stating they "Completely agreed", compared to the 24.8 % (*n*=31) who stated that they "Completely disagreed" and 16 % (*n*=20) saying they "Somewhat disagreed". The doctors had a more negative stance on whether the HIS had helped reduce medical errors, with the highest percentage of doctors, 35.2 % (*n*=44), stating that they "Completely disagreed" with the statement, followed by 23.2 % (*n*=29) saying that they "Somewhat agreed", and 20.8 % (*n*=26) being indecisive.

Table 16. Doctors' Levels of Agreement with Statements Regarding the HIS

	I completely disagree	I somewhat disagree	I neither disagree nor agree	I somewhat agree	I completely agree	Total
The HIS system allows me to access patient's data outside of my office						
Frequency	54	19	19	26	7	125
Percent	43.2	15.2	15.2	20.8	5.6	100.0
The system has helped improve preventive care of the patients						
Frequency	51	22	24	28	0	125
Percent	40.8	17.6	19.2	22.4	0	100.0
The system enables more quality care of chronic patients						
Frequency	31	20	22	46	6	125
Percent	24.8	16.0	17.6	36.8	4.8	100.0
The system has helped reduce medical errors						
Frequency	44	23	26	29	3	125
Percent	35.2	18.4	20.8	23.2	2.4	100.0

The doctors at the Health Center of the Sarajevo Canton would overwhelmingly welcome a HIS that would provide them with the clinical decision-making support, with almost the majority, namely, 49.6 % (*n*=62) stating that they would "Always use it", 45.6 % (*n*=57) stating that they would "Sometimes use it" and only 4.8 % (*n*=6) stating that they would "Not use it" but rather rely on their own knowledge and intuition, as seen in the Figure 15 below.

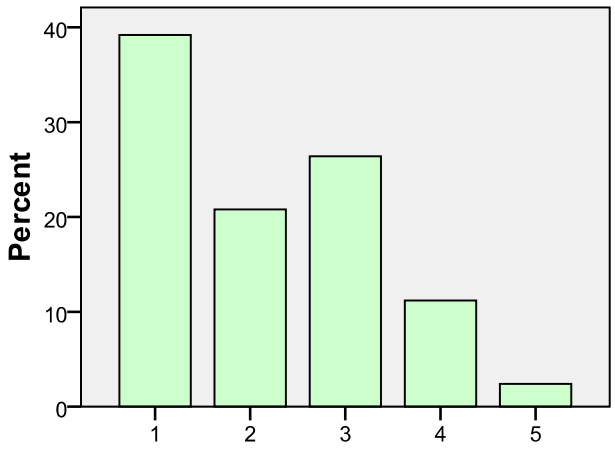
Figure 15. Doctors' Opinions on whether the HIS Should Contain the Clinical-Decision Support Feature



3.8 Data Security

When doctors were asked to rate, on the scale from 1 to 5, a very significant aspect of any HIS – the patients' data security within the system, where 1 stood for "Very weak" and 5 for "Very strong", they rated the security, based on their experience, as weak, the mean being 2.17, median 2.10 and mode 1, with the standard deviation of 1.14. The Figure 16 shows the distribution of doctors' ratings across the scale. As much as 39.2 % (*n*=49) of doctors rated the security of patient's data in the HIS with the lowest grade of 1, 20.8 % (*n*=26) rated it with the grade 2, while 26.4 % (*n*=33) and 11.2 % (*n*=14) rated it with grades 3 and 4 respectivelly. Only 2.4 % (*n*=3) of doctors gave the highest grade of 5 to the security of the patients' data. These findings are troubling, and steps must be taken to improve the security of patients' data within the system.

Figure 16. Doctors' Rating of Patients' Data Security in the HIS, Based on Their Experience



When further investigating the doctors' stances on the freedom of accessing the patients' data, the majority of doctors, 64.0 % (*n*=80), were of the opinion that the doctors should be able to access EHR of every patient but under certain conditions, while 19.2 % (*n*=24) stated that doctors should have unconditional access to every patient's data, with only 13.6 % (*n*=17) being of the opinion that doctors should not be able to access every patient's data under any conditions (Table 17). We could not get a specific confirmation whether there were certain access restrictions within the HIS at the Family Practice of the Health Center of the Sarajevo Canton, but anecdotal information indicated that all doctors could access every patient's data, with their access being logged.

Table 17. Doctors' Opinions on whether Every Doctor Should Be Able to Access Every Patient's EHR

		Frequency	Percent
Valid	Yes, but under certain conditions	80	64.0
	Yes, without conditions	24	19.2
	No	17	13.6
	I don't know	4	3.2
	Total	125	100.0

3.9 Integration and Communication

When asked about their satisfaction with the IT system's connection and integration with other departments/health institutions in the Canton, on the scale from "Very dissatisfied" to "Very satisfied" (Table 18), the doctors were most satisfied with the HIS' connection to the pharmacies – combined percentage for answers "Satisfied" and "Very satisfied" amounting to 69.6 % (*n*=87). For the departments within the Health Center, the doctors were most satisfied with connection to the Radiology – for which the combined percentage for answers "Satisfied" and "Very satisfied" was 63.2 % (*n*=79), followed by 51.2 % (*n*=64) for the Specialty-consultative departments.

They were not satisfied with the connection to the Diagnostic laboratory, where the combined percentage for answers "Very dissatisfied" and "Dissatisfied" stood at 48 % (*n*=60), while 28.8 % (*n*=36) where "Neither dissatisfied not satisfied", which was probably due to the fact that out of 9 organizational units within the Health Center, only 2 of them had the full integration of the Laboratory and the EHR. The dissatisfaction with the integration of the external providers of the health care services was always higher than satisfaction, where the combined dissatisfaction with the connection to the University Clinical Center of Sarajevo stood at 44.8 % (*n*=56), to the General Hospital at 36.8 %

(*n*=46) and to other institutes and health institutions at the higher 51.2 % (*n*=64), which is shown in more detail in the Table 18.

Table 18. The Levels of Doctors' Satisfaction with the HIS' Connection to Other Departments/Institutions in the Sarajevo Canton

	Very dissatisfied	Dissatisfied	Neither dissatisfied nor satisfied	Satisfied	Very satisfied	Total
[Pharmacies]						
Frequency	13	10	15	70	17	125
Percent	10.4	8.0	12.0	56.0	13.6	100.0
[Diagnostic laboratory]						
Frequency	45	15	36	24	5	125
Percent	36.0	12.0	28.8	19.2	4.0	100.0
[Radiology]						
Frequency	10	16	20	70	9	125
Percent	8.0	12.8	16.0	56.0	7.2	100.0
[Specialty-consultative departments]						
Frequency	12	24	25	57	7	125
Percent	9.6	19.2	20.0	45.6	5.6	100.0
[University Clinical Center of Sarajevo]						
Frequency	30	26	34	31	4	125
Percent	24.0	20.8	27.2	24.8	3.2	100.0
[The General Hospital]						
Frequency	31	15	40	37	2	125
Percent	24.8	12.0	32.0	29.6	1.6	100.0
[Other health institutions/ institutes in Canton]						
Frequency	38	26	49	11	1	125
Percent	30.4	20.8	39.2	8.8	.8	100.0

The doctors were more dissatisfied (*n*=57, 45.6 %) with the updating of lists of drugs and orthopedic devices within the HIS, than they were satisfied (*n*=43, 34.4 %), with 20.0 % (*n*=25) stating they “Don't know”, as seen in the Table 19. At the time, the HIS did not provide the lists of orthopedic devices, and that was one source of doctors’ dissatisfaction.

Table 19. Doctors' Level of Satisfaction with the Updating of Lists of Drugs and Orthopedic Devices in the HIS

	Frequency	Percent
Dissatisfied	57	45.6
Satisfied	43	34.4
I don't know	25	20.0
Total	125	100.0

Every high-quality HIS should not only allow for the accessibility and transfer of patient data, but also for the efficient communication between the health care staff. Rating their satisfaction with the capacity for communication with their colleagues provided by the system on the scale from 1 to 5, where 1 indicated "Very dissatisfied" and 5 "Very satisfied", the doctors in the Health Center of the Sarajevo Canton showed they were not very impressed with the communication possibilities provided by its HIS – the mean rating was 2.63 and mode 3, with SD of 1.051, as shown in the Table 20.

Table 20. Doctors' Satisfaction with the Capacity for Communication with their Colleagues Provided by the HIS

N	Valid	125
	Missing	0
Mean		2.63
Median		3.00
Mode		3
Std. Deviation		1.051

However, when asked whether they were willing to communicate with their patients by e-mail or through the HIS (Table 21), almost a third of the surveyed doctors, 30.4 % (*n*=38), stated that they definitely would not want to communicate with their patients electronically, while the majority of 57.6 % (*n*=72) stated that they would be willing to communicate with their patients using the IC technology, but to a limited extent. Only 12.0 % (*n*=15) were ready to communicate with their patients completely by e-mail or through the system.

Table 21. Doctors' Willingness to Communicate with Their Patients by E-mail or through the HIS

		Frequency	Percent
Valid	Yes, but limited	72	57.6
	Yes, completely	15	12.0
	No	38	30.4
	Total	125	100.0

There was no statistically significant difference between the respondents' age, gender, education, self-reported computer literacy or self-reported average patient load, and the levels of doctors' willingness to communicate with their patients electronically.

The limited number of doctors who would be willing to fully communicate with their patients by e-mail or through the HIS raises concerns when considering further modernization of provision of health care services to the patients, which, like telemedicine, employs IC technologies to a great extent. The results of the survey indicated that there might be resistance among a significant percentage of employees when the adoption of such novel forms of communication is concerned.

4 DISCUSSION AND RECOMMENDATIONS

Numerous studies have indicated that medical workers face a steep learning curve when introduced to health information systems, often lacking time to devote to learning and becoming proficient at using all features of the system (Unertl et al., 2009). Incomplete and inconsistent use of system's features results in insufficient patient data, with negative consequences on reporting and, possibly, policy design. Lack of proficiency when using the programs can also negatively influence the doctor-patient relationship, decreasing confidence and marring the image of a doctor. Considering that the mean rating of the training that had been provided to the doctors of the Health Center of Sarajevo was 3.13 on the scale from 1 to 5, it would be of importance to the Health Center's management to provide additional training to the employees who need it, in order to improve the efficiency of the system's use and quality and quantity of data inserted into the system.

Despite the fact that the doctors in the Center's Family Practice used the HIS frequently, with 83.2 % of respondents using the EHR either all the time or daily, and 97.6 % respondents using the e-prescription with the same frequency, the physicians did not rate the programs favorably – only 36.8 % rated the EHR program as either "Good" or "Very good", while the situation was somewhat better for the e-prescription program, where 58.4 % rated it as either "Good" or "Very good". The post hoc test indicated that the doctors who gave

higher ratings to the training also gave higher ratings to the programs themselves, while the specialist doctors tended to rate both programs less favorably in comparison to the medical doctors.

What the doctors thought of the programs was also reflected in their rating of the more specific segments of the program, such as visual design, finding patient's data, speed of the system's response, etc., where the mean of all ratings was 2.63, on the scale from 1 to 5, while the mean of doctor's ratings on programs' simplicity of use and interface clarity was somewhat higher and stood at 3.187. The lack of satisfaction with the system's speed and design can negatively influence a doctor's readiness to use the HIS to its full potential, reducing the use only to the necessary functions which could not be performed otherwise, such as the prescriptions, and can be detrimental to the amount and quality of data inserted into the system.

A significant percentage of family doctors (n=42, 38.5 %) reported facing problems with system downtime on the daily basis, while somewhat smaller percentage (n=34, 31.2 %) reported this challenge taking place monthly. Since problems with connectivity and program's speed negatively affect doctor's work, overall health care quality and patient's satisfaction regarding their care, the Health Center management, in coordination with the IT department and the HIS provider, should analyze this problem and pursue action to resolve it or lessen its effect.

When further considering the effect of the HIS on the work efficiency, the survey results point to the fact that it was mixed. The use of the EHR resulted in decreased work efficiency, with the 56.8 % of doctors reporting decrease in efficiency and only 27.2 %. reporting that it improved their efficiency. For the e-prescription program the situation was opposite, with 57.6 % of doctors reporting that e-prescription use improved their work efficiency, while 25.6 % reported the negative effect. With the legal obligation for doctors to write down patient data in the paper patients' health records, entering that data into EHR as well only doubled the doctors' workload, with no obvious benefits for them, so it was not possible at this point to precisely determine the true nature of EHR's effect on work efficiency and intensity.

The statistical tests showed that the doctors who gave higher scores to the training on the use of the programs and those that confirmed being provided with the user manual on the programs, were also those that gave a more positive score on how the EHR and e-prescription programs affected their work efficiency. However, the use of the three-month e-prescription function appeared to only moderately reduce the patient load per doctor, with the mean rating of 3.1 and mode 3, on the scale from 1 to 5.

The self-reported quality of patient data that the doctors entered into the EHRs was also mediocre, with the mean rating of 2.86 on the scale from 1 to 5, which was probably due to

the fact that the doctors were overburdened by the number of patients and since they were legally obliged to write down patients' data into the paper records, they hardly had the time to write that data in the EHRs as well. The majority of doctors also reported that the quality of their relationship with the patients suffered because of the prolonged time they spent looking at the computer screen, and this only further confirmed how important it would be to ensure that the doctors be well-trained to use the programs and that the design of the programs be simple and intuitive in order to reduce the time doctors spent facing the screen, rather than looking at the patient.

The further analysis of the effect of the HIS on the quality of patient's care indicated that only 26.4 % of doctors somewhat or completely agreed that the HIS provided them with the capability to access their patients' data outside of their office, raising the question to what extent the doctors were aware of the system's functions at all. The majority of doctors were not satisfied with the HIS' effect on enhancement of preventive services provided to the patient, while they had a somewhat more positive opinion of how the system influenced the care of patients with chronic diseases. The doctors in the Health Center of the Sarajevo Canton would overwhelmingly welcome a HIS that would provide them with the clinical decision-making support, with 95.2 % stating that they would either always or sometimes use it, and only 4.8 % stating that they would not use it, but rather rely on their own knowledge and intuition.

When the doctors were asked to rate a very significant aspect of any HIS – the patients' data security within the system, on the scale from 1 to 5, where 1 stood for "Very weak" and 5 for "Very strong", the doctors rated the security, based on their experience, as weak. These findings were troubling, and since the doctors gave scores based on their experience with working with the HIS, the management of the Health Center must work with the provider and the IT department to improve the security of patients' data within the system. Discussions with competent ministries and institutions must be initiated on this issue, perhaps also introducing a function which would enable patients to see on-line who accesses their health data. Although we could not get definite confirmation on possible restrictions on data access within the HIS in the Health Center of the Sarajevo Canton, the available information indicated that all doctors could access every patient's data, with their access and/or made changes being logged. However, majority of the physicians working at the Family Practice, namely 64 %, were of the opinion that doctors should be able to access every patient's data, but only under certain conditions.

Regarding the HIS' integration with other departments/health institutions in the Canton and the level of communication provided by the system, the doctors were the most satisfied (76 %) with its connection to the pharmacies, then with the connection to the Radiology and specialty-consultative departments, but were dissatisfied with its integration with the Laboratory and other health institutions such as the University Clinical Center of Sarajevo, the General Hospital and other institutes, such as those for the public health, health

insurance, women's health, etc. The doctors were also not impressed with the capability for communication with their colleagues through the HIS, whose mean score stood at 2.63, on the scale 1 to 5. Having in mind that the purpose of a quality and functioning patient's electronic health record system is to provide continuing and longitudinal care to the patient, it is obvious that a lot more must be done by the relevant ministries and the Health Insurance Institute of the Sarajevo Canton to continue integration of all institutions within the Canton in order to provide for the accessibility of patient's data across multiple providers from different levels of health care.

Despite their dissatisfaction with the connection to other departments/institutions and the level of communication with their colleagues provided by the HIS, almost a third of all physicians stated that they would not want to communicate with their patients (30.4 %) either through the HIS or by e-mail, while 57.6 % said they would be willing to do so, but to a limited extent. Since the novel ways of communication with the patients might be introduced during the modernization of health care services in the future, the management of the Health Center should do more to educate the staff, reduce the number of patients per doctor and alleviate the doctors' fears that such new forms of communicating with their patients would only overburden them.

Based on the general analysis of the HIS and its implementation in the Health Center of the Sarajevo Canton, along with the results of the survey conducted among the doctors working in the Center's Family Practice, numerous recommendations for the system's improvements could be made. The two most important, comprehensive recommendations are:

- to design, adopt and implement legislation which would regulate the electronic signature, standardization and use of the health IT systems in health institutions and safety of patients' data;
- to ensure understanding and cooperation between all actors in the process of HIS design and implementation in order to produce systems which are efficient, visually and functionally adequate and which support business processes in the health care.

Specific comments on how to improve the EHR or e-prescription program were provided by 69 out of 125 respondents to the survey conducted among the doctors in the Family Practice of the Health Center. The most frequent recommendations for possible EHR improvements were the following:

1. To design a completely new program in consultation with the professionals working at the Family Practice;
2. To simplify the EHR – less clicks, less typing, better interface clarity, all diagnostics in one place, the initial EHR window should show all the necessary and recent patient's information: diseases, therapy, test results, allergies, risk factors, immunizations;

3. To ensure better protection of doctors' passwords in order to prevent unauthorized personnel from accessing patients' data;
4. To completely integrate the EHR and e-prescription programs in order to prevent efficiency loss when logging from one program into another;
5. To improve integration with other departments (e.g. laboratory, etc.) and other institutions aimed at better data exchange (all clinics at the University Clinical Center, institutes for managing sick-leaves);
6. To improve its functionality – enable electronic sick-leave reports, reporting on performed services, disease prevalence, prescribed drugs, etc., allergy and drug interaction warnings, preventive services reminders, integrated CVR (hereinafter: cardiovascular risk) and BMI (hereinafter: body-mass index) calculators;
7. To speed up the programs' response.

The most frequent recommendations on possible e-prescription program improvements were the following:

1. To simplify the program – currently too many clicks and data entering just to send a prescription;
2. To enable doctors to annul the sent prescription, without calling the help-desk;
3. To simplify the process of changing a patient's long-term and short-term therapy;
4. To enable doctors to see the exact date the medicine was taken from the pharmacy;
5. To solve the problems arising from prescribing a three-month therapy with drug packages containing less pills than needed and to enable two-month therapy;
6. To ensure that data from the EHR is visible when typing the e-prescription;
7. To enable the addition of other disease codes for the long-term therapy.

Some of the doctors' suggestions concerned the organizational aspects or work, such as:

1. To remove the paper health records from the work process;
2. To reduce the number of patients per doctor;
3. To ensure that the management and/or IT staff listen to and take into consideration the suggestions on the possible improvements to the HIS given by the doctors, which had not been the case.

Further development of the HIS, especially within the primary level of health care should include design and promotion of a patient's portal, where patients could access their health information and education materials, and which would provide functions such as the electronic reminders for preventive services and electronic scheduling.

The successful full implementation and effective and efficient use of the HIS will depend upon the willingness of all actors in the process of the HIS implementation, namely the

government ministries and institutes, managements of health institutions and the doctors as the final users, to work towards resolving the previously stated problems and recognizing the potential of a quality and secure electronic management of patient data.

5 FUTURE PERSPECTIVES

The health care in Bosnia and Herzegovina will, inevitably, have to keep abreast of the global trends and innovations in medical informatics, albeit at a slow pace. It will take place either due to public pressure for more efficient services or due to brain-drain of skilled health care workers and subsequent need for redesign of business processes in the field of health care.

The introduction of patients' electronic health records and electronic prescription programs constituted just the beginning. From communicating with the doctor through the e-mail or video-chats, to wearing devices such as holters, temperature, apnea or other microelectronic sensors, which report through Wi-Fi or mobile technology patient's health data or health status in real-time to their doctor, thus enabling fast and adequate treatment of the problem, the medical informatics and bioinformatics are fields with an enormous potential for growth in the following decades. Telemedicine and mHealth, or telemedicine over a mobile platform, are becoming more real, considering that 2 billion people use smartphones and other mobile devices globally today (Slovensky, Malvey, & Neigel, 2017). People are predominantly searching for medical advice on the internet, so why not provide them with a platform to obtain that information from a reliable source – their own health care providers? Sometimes, people need only consultation regarding their own or their relative's health, and in cases of non-serious health conditions, this consultation, performed by means of an e-mail or video-chat and with an access to the EHR or e-prescription programs, could be more time- and cost-efficient, and could help keep, especially primary health care doctors, from being overburdened by patients who come to their office just to take a prescription refill or referral. Besides taking precious, both doctor's and patient's time, these types of visits prohibit doctors from engaging in important activities of disease prevention. The prevention activities could also be intensively supported by the IC technologies – one example being reminders within the EHR system which point out to the doctor, or directly to the patient by an e-mail or SMS, that it is time for a certain preventive test, such as a Pap smear, colonoscopy or mammography.

As patients get more interested in their own health by accessing information online, it is important to utilize this interest and move towards encouraging patients and general population to take a more proactive role in regards to their health by implementing the concept of self-care which is guided by a clinician, especially in the cases of well-controlled chronic conditions, supported as well by a quality educational material and tools for patients (National Academy of Engineering and Institute of Medicine Committee on Engineering

and the Health Care System, 2005). These activities could be performed through the use of the patient's portal, at which individual patients could access their own medical data and receive reminders and instructions for further measures and life-style changes aimed at improving their health.

Besides obvious benefits for an individual, the IC technology in health care could be used at a much wider scale, aggregating amounts of data at an unprecedented level. In the United Kingdom, the National Health System – NHS, has been collecting patient data already for decades, but is now moving towards removing identifiers from that data and rendering it anonymous, thereby protecting vulnerable patients' information and making this "big data" available for research through the system named the Clinical Practice Research Datalink - CPRD. By 2016, the data from CPRD was used for 2000 research papers which were published and whose results had significant impact on the practice, especially in the medical fields such as cardiovascular health, cancer research, digestive diseases and mental health (Kousoulis, Rafi, & de Lusignan, 2015). In the years to come, it will tie this data to other types of information such as the UK's Biobank, pollution and social care. This pool of data will hopefully be exploited by experts to further their knowledge on drug interactions and unusual effects on different diseases, possible failures within the health care system and quality of provided services (Sample, 2012).

However, Slovensky et al. (2017) insist that in order to use the IC and biotechnology to its fullest potential, the health care staff have to have formal education and training in this field. Despite the fact that today's new experts are digital natives and use the IC technology in their everyday lives very successfully, they argue that it is not sufficient, and that training in these technologies should be incorporated into formal curricula at the nursing and medical schools. They point out that the health care staff should practice how to use this technology in various contexts; how to conduct a consultation using the audio or video connection where patient's cues are sometimes muted and the health worker has to learn how to ask the adequate questions and which information to seek; how to collaborate with members of multi-professional teams and how to take into consideration the issues of confidentiality and protection of patient's interest during the course of such forms of medical consultation.

When talking about what the future might bring in the field of health informatics, experts point out that these developments will not only influence curricula at the universities, but will also affect the job market, either by rendering some of the health care staff redundant or requiring more additional and specifically educated workforce. It will also call for reengineering of business processes in the health care institutions, although these institutions do not easily accept and implement these changes. Lapão (2016) argues that for certain forms of IC technology advancements' implementation in health care, a reduced number of experts will be needed, for example in eRadiology, where all radiologists could be grouped in one place, reading patients' images coming from different locations, ensuring better work organization in case of other radiologist's absence, and, perhaps, providing

capacity for the second opinion, as well. However, they also argue that as population grows older and the prevalence of chronic diseases increases, so will the demand for more experts who have the skills to interact with the sophisticated medical devices and perform readings of physiological data sent by various wearable sensors, perhaps even creating completely new professions, such as different types of technicians, nurse specialists, health data analysts etc.

Experts today are somewhat more pessimistic regarding the development of more complex decision-support systems. Van Bemmel and McCray (2016, p. 16) point out that "The experience from the past teaches us an important lesson for the future: only processes that can be completely formalized are suitable for computer support." Therefore, its simpler forms in which such systems provide alerts in cases of drug interaction or counter-indication are proving invaluable. However, since decisions on diagnosis and therapy in complex cases require human intelligence and intuition, experts believe that in the near future there will be no major breakthroughs concerning automation of these activities, and that the research and development in this field should focus more on ensuring successful interaction between the human professionals and the machines aimed at providing the most effective and efficient health care services to the patients.

CONCLUSION

The medical informatics and biotechnology are fields with an enormous potential for growth in the course of the next decades. Considering that one of the aims of a quality primary health care is to provide continuous and longitudinal health care services with an accent on prevention and chronic diseases management, a well-designed health information system, with an integrated patient's electronic health record as its basis, could greatly support the provision of such services to a population. On the other hand, a slow, complicated and counterintuitive HIS would only additionally burden the already overstretched health care staff and possibly negatively affect the patient-doctor relationship.

In the Health Center of the Sarajevo Canton, the largest institution in Bosnia and Herzegovina providing primary health care, the health information system was introduced during the course of 2013 and 2014. Since then, there have been no known instances of conducted surveys among the end-users of the system. The research objectives of this master thesis were to present the HIS at the Health Center of the Sarajevo Canton and explore extent of its use, satisfaction with the system, level of functionality and integration with other departments and health institutions, effects on work efficiency and possible future improvements and additions. The objectives were accomplished by conducting a semi-structured interview with one family doctor and distributing a survey among the doctors working at the Family Practice of the Health Center. The first part of the thesis gave the overview of the characteristics of the HIS within the Health Center. It was followed by

the survey results which indicated that the extent of the HIS usage was satisfactory, but that the doctors were not completely satisfied with the training they had received. In regard to the research question on the system's effect on the workflow, the survey respondents gave higher ratings to the e-prescription program and its effect on their work efficiency in comparison to the EHR program which they recommended to be redesigned to better fit the business processes in the Family Practice.

In order to provide the health care staff with a quality and reliable health information system, the relevant government bodies and all health institutions must work together towards this aim, in the process consulting the experts and taking into account the opinions of doctors and nurses working at the Practice, which has not been the case so far. As the first step, the legislation must be adapted to ensure that the doctors no longer have to concurrently manage both the paper and electronic patient records. The research question on the level of the HIS integration indicated that the next steps should include additional training and further connection to the other departments within the Health Center, specifically the Laboratory, and other institutions, such as the remaining clinics of the University Clinical Center of Sarajevo, the women's health and public health institutes, and others.

Regarding the research question on the functionality and future improvements of the system, the survey results inferred that the development of additional functions, such as the electronic sick leave reporting, patient's portal and preventive care reminders, was also required. The whole health care system could also benefit, in terms of a better cost-overview and identification of possible savings, from introduction of the financial modules which would be linked to the Cantonal Health Insurance Institute. Nevertheless, the relevant institutions should ensure that the doctors have the capability and adequate time to enter quality patient health data within the HIS, which could subsequently be used for statistics and health policy design. But, the most important of all, considering the low score given by the doctors to this aspect of the HIS in the survey, more must be done to improve the security of patients' data within the system, ensuring that it be protected from unauthorized access and that the patients become the owners of their health data.

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APPENDIXES

LIST OF APPENDIXES

APPENDIX A: List of Abbreviations

AIS	Ambulatory Information System
B&H	Bosnia and Herzegovina
BMI	Body-mass index
CAS	Central Authentication Service
CDS	Clinical decision support
CEB	Council of Europe Development Bank
CEN	Comité Européen de Normalisation
CPOE	Computer-based physician order entry
CPRD	Clinical Practice Research Datalink
CSUQ	Computer System Usability Questionnaire
CVR	Cardiovascular risk
DHHS	Department of Health and Human Services
DICOM	Digital Imaging and Communications in Medicine
EHR	Electronic health record
EUCS	End user computing satisfaction
HIS	Health information system
HISA	Healthcare Information Systems Architecture
HL7	Health Level 7 standard
HSEP	Health Sector Enhancement Project
IBM	International Business Machines
IC	Information-communication
ICD-10	International Classification of Diseases and Related Health Problems (10th edition)
ICPS-2	International Classification of Primary Care
ID	Identity document
IHE	Integrating the Healthcare Enterprise
IOM	Institute of Medicine
IT	Information technology
KM	Convertible Mark
LIS	Laboratory information system
NHS	National Health System
ONCHIT	Office of the National Coordinator for Health Information Technology
POMR	Problem-oriented system
PACS	Picture archiving communication system
PIN	Personal Identification Number
PCIP	Primary Care Information Project
SMS	Short message service
UK	United Kingdom
USA	United States of America

Wi-Fi	Wireless Fidelity
VAT	Value-added tax
VPN	Virtual Private Network

APPENDIX B: The Survey

"Examining Effects of Information System Introduction on Services Provided by Family Physicians at the Health Center of the Sarajevo Canton"

Dear Mr/Ms,

as part of my Master's Degree Program at the School of Economics, University of Sarajevo and the School of Economics, University of Ljubljana, I am conducting a survey among the doctors in the Family Medicine of the Health Center of Sarajevo Canton on the topic regarding the effects of health information system introduction on provision of medical services to the patients. Your contribution is of paramount importance for successful completion of my final paper, and therefore I am kindly asking you to precisely and completely fill out this survey.

I am very grateful for your time and cooperation.

Esma Zlatar

1. **How satisfied were you with the training on how to use patient's electronic health record (EHR) and e-prescription programs?**

	1	2	3	4	5	
Very dissatisfied	◯	◯	◯	◯	◯	Very satisfied

2. **Were you provided with a printed or digital user instruction manual for EHR and e-prescription programs?**

   ◯ Yes
   ◯ No
   ◯ Don't know

3. **Would you like to get more training on using the programs?**

   ◯ Yes
   ◯ No
   ◯

4. **How often on average do you use the following programs**

	Never	Monthly	Weekly	Daily	Once in six months	All the time
Electronic health record						
E-prescription						

5. **How would you generally rate the following programs**

	Very bad	Bad	Neither bad nor good	Good	Very good
Electronic health record					
E-prescription					

6. **Please grade the following aspects of the programs, where 1 is the lowest grade, and 5 the highest**

	1	2	3	4	5
Appearance/visual design					
Speed of the system's response					
Logic of field and function display					
Level of integration of EHR and e-prescription programs					
Finding desired patient's data					
Speed of performing routine tasks in the program					
Making changes/corrections					
Programs' functions					

7. **How familiar are you with the functions of the patient's electronic health record program?**

- I am completely unfamiliar with the functions
- I am somewhat unfamiliar with the functions
- I know basic functions
- I am familiar with majority of functions
- I am familiar with all the functions

8. **Please grade the simplicity of use and interface clarity for various segments of the system, where 1 is the lowest grade, and 5 the highest**

	1	2	3	4	5
General patient data					
Patient's acute diseases					
Patient's chronic diseases					
Patient's medication					
Referrals					
Drug prescriptions					
Information from other health institutions					
Making reports					

9. **How often do you experience problems with the connection and slowdown when using the programs?**

- ◯ With every patient
- ◯ Daily
- ◯ Weekly
- ◯ Monthly
- ◯ Less than monthly

10. **How did the following programs affect your work efficiency after one month of use?**

	It greatly reduced my efficiency	It slightly reduced my efficiency	It neither reduced nor increased my efficiency	It somewhat increased my efficiency	It greatly increased my efficiency
EHR					
E-prescription					

11. **To what extent has issuing the three-month-prescription reduced your patient load?**

	1	2	3	4	5	
Very little						Very much

12. **How satisfied are you with the health IT system's connection to other departments/institutions in the Sarajevo Canton:**

	Very dissatisfied	Dissatisfied	Neither dissatisfied nor satisfied	Satisfied	Very satisfied
Pharmacies					
Diagnostic laboratory					
Radiology					
Specialty-consultative departments					
University Clinical Center of Sarajevo					
The General Hospital					
Other health institutions/institutes in Sarajevo Canton					

13. **How satisfied are you with the updating of lists of drugs and orthopedic devices within the IT system?**

- Dissatisfied
- Satisfied
- I don't know

14. **How would you rate the quality of patient data you enter into the EHRs?**

	1	2	3	4	5	
Very bad						Very good

15. **Does looking at the computer monitor during the patient visit negatively affect the quality of your relationship with the patient?**

- It affects significantly
- It affects, but not significantly
- It doesn't affect negatively
- I don't know

16. **Please state to which extent you agree with the following statements:**

	I completely disagree	I somewhat disagree	I neither disagree nor agree	I somewhat agree	I completely agree
The IT system allows me to access patient's data outside of my office	◯	◯	◯	◯	◯
The system has helped improve preventive care of the patients	◯	◯	◯	◯	◯
The system enables more quality care of the chronic patients	◯	◯	◯	◯	◯
The system has helped reduce medical errors	◯	◯	◯	◯	◯

17. **Should the IT health system contain the medical knowledge database which would support your clinical decision-making process?**

- ◯ Yes, I would always use it
- ◯ Yes, I would sometimes use it
- ◯ No, I rely on my knowledge and intuition and I would never use it

18. **From your previous experience, how would you rate the security of patients' data in the programs?**

	1	2	3	4	5	
Very weak	◯	◯	◯	◯	◯	Very strong

19. **Should every doctor be able to access the EHR of every patient?**

- ◯ Yes, without conditions
- ◯ Yes, but under certain conditions
- ◯ No
- ◯ I don't know

20. **How satisfied are you with capacity for communication with your colleagues that is provided by the HIS?**

	1	2	3	4	5	
Very dissatisfied	◯	◯	◯	◯	◯	Very satisfied

21. **Would you be willing to communicate with your patient by e-mail or through the IT health system?**

- ◯ Yes, completely
- ◯ Yes, but limited
- ◯ No

22. **Please state your suggestions for EHR program improvements**

23. **Please state your suggestions for e-prescription program improvements**

24. **Your gender?**

- ◯ Female
- ◯ Male

25. **Your age?**

26. **Health Center at which you work?**

- ◯ HC Stari Grad
- ◯ HC Centar
- ◯ HC Novo Sarajevo
- ◯ HC Novi Grad
- ◯ HC Ilidža
- ◯ HC Vogošća
- ◯ HC Ilijaš
- ◯ HC Hadžići
- ◯ HC Trnovo

27. **Your profession?**

- ◯ Medical doctor
- ◯ Specialist

28. **If you are a specialist, what is your specialty?**

29. **How many patients do you see on average per day?**

30. **How would you rate your computer literacy?**

	1	2	3	4	5	
Very bad	◯	◯	◯	◯	◯	Very good

31. **How long have you been working with the health information system in the Health Center of Sarajevo Canton?**

Thank you for your contribution!