Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Information Engineering

Bachelor Thesis

Electronic Medical Report and eHealth

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BACHELOR THESIS ASSIGNMENT

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Informatics

Thesis title

Electronic medical report and e-health

Objectives of thesis

The bachelor thesis will make the evaluation of the current state of Czech electronic medical report system IZIP. The thesis will also investigate e-health and e-government.

The partial goals are:
- to make an overview of the current state of the art of e-health and e-government in the Czech Republic,
- to compare IZIP to another similar projects in the Czech Republic,
- to make a final evaluation of IZIP and to suggest further development.

Methodology

Methodology of the thesis will be based on study of publications connected with the topic. The practical part will be focused on analysis of e-health systems and comparison of system features. Based on outcome of above mentioned methodologies the conclusion will be formulated.

The proposed extent of the thesis

30 – 40 pages

Keywords

IZIP, E-government, Electronical medical report, Government, Healthcare.

Recommended information sources

CURRIE, Wendy L. a Jonathan J.M. SEDDON. A cross-national analysis of eHealth in the European Union: Some policy and research directions. Information & Management [online]. 2014, 51(6): 783-797 [cit. 2015-05-22]. DOI: 10.1016/j.im.2014.04.004. ISSN 03787206

MANTAS, John, Stig Kjær ANDERSEN, Maria Christina MAZZOLENI, Bernd BLOBEL, Silvana QUAGLINI, Anne MOEN, Jana ZVÁROVÁ, Lenka LHOTSKÁ, Libor SEIDL, et al. Health Data Collecting and Sharing: Case Studies of Czech e-Health Applications. Studies in Health Technology [online]. 2012, 180: 672-676 [cit. 2015-05-22]. ISSN 09269630.

MATES, P. – SMEJKAL, V. *E-government v České republice : právní a technologické aspekty.* Praha: Leges, 2012. ISBN 978-80-87576-36-6.

PLEVOVÁ, Ilona. Management v ošetřovatelství. 1. vyd. Praha: Grada, 2012, 304 s. Sestra (Grada). ISBN 978-80-247-3871-0.

ŠTĚDROŇ, B. *Úvod do eGovernmentu v České republice : právní a technický průvodce.* Praha: Úřad vlády České republiky, 2007. ISBN 978-80-87041-25-3.

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Declaration

I declare that I have worked on my bachelor thesis titled "Electronic medical report and eHealth" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the bachelor thesis, I declare that the thesis does not break copyrights of any their person.

In Prague on 14.3.2016   _____

Acknowledgement

Elektronická zdravotní knížka a eHealth

Souhrn

Tato práce se věnuje problematice elektronického zdravotnictví neboli eHealth. Hlavním cílem této práce je identifikovat a poskytnout přehled o eHealth, o elektronickém zdravotnictví v České republice spolu s českými a evropskými projekty eHealth. Na základě získaných poznatků z praktické části, autor práce poskytuje návrh systémového řešení.

Teoretická část je zaměřena na definici eHealth, založená na odborné literatuře. To zahrnuje především eHealth v České republice, datové standardy a rozvoj eHealth.

Praktická část je zaměřena na srovnání eHealth systémů poskytované českými pojišťovnami. Z rozhovoru se specialistou z oblasti eHealth, jsou navrhovány dvě systémová řešení vytvořené autorem práce. Řešení jsou poté analyzovány pomocí SWOT analýzy.

V poslední části práce je zformulován závěr na základě získaných poznatků z teoretické a praktické části.

Klíčová slova: eHealth, Elektronická zdravotní knížka, IZIP, Zdraví, Datové standardy, Zdravotní dokumentace, Pacient, Doktor,

Electronic Medical Report and eHealth

Summary

This bachelor thesis is devoted to the topic of electronic health or eHealth. The main goal of the thesis is to identify and provide an overview of eHealth, electronic health in the Czech Republic along with Czech and European eHealth projects. Based on the gained findings from the practical part, author will provide a system solution.

The theoretical part focuses on the definition of eHealth, based on the literature. This mainly includes eHealth in the Czech Republic, Data standards and development of the eHealth.

The practical part is focused on the comparison of eHealth and eHealth related tools. From provided interview with eHealth systems specialist, two system solutions created by the author of the thesis are proposed. Solutions are later analyzed by the SWOT analysis.

In the last part of the thesis final evaluation of the topic and results from the practical part is given.

Keywords: eHealth, Electronic medical report, ICT, Health, IZIP, Data Standards, Medical Documentation, Patient, Doctor

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1 Introduction

Electronic health, or eHealth is nowadays a part of health care of most developed countries around the world. Its mission is to provide easy and accessible health care for the citizens. They are able to have an overview about their medical conditions and have a better understanding of the treatment they receive. On the other side, eHealth also serves for doctors. It reduces the administrative part of their work, helps the communication between the patient and doctor. Despite these undeniable advantages, it seems very hard to enforce eHealth in some countries such as in the Czech Republic. Frequent scandals around eHealth projects but also various public tenders create an environment which general public does not trust. Disunity, lack of government support, lack of motivation, all of these aspects can be reasons why the Czech Republic still does not have a proper eHealth system.

Connectivity within different countries in Europe or elsewhere is a big advantage in various fields and especially in health. United participation in international projects should be a priority for each ministry of health. Communication on international level can help to develop systems which would be able to be used not just in one country. It brings safer and more transparent provided care. Medical staff can easily access medical history of each patient, does not matter which country is he or she coming from.

2 Objectives and Methodology

The bachelor thesis will make the evaluation of the current state of Czech electronic medical report system IZIP. The thesis will also investigate eHealth, ePrescription and another projects.

The partial goals are to make an overview of the current state of the eHealth in the Czech Republic, based on the literature review and published studies by appropriate institutions. Next goal to compare IZIP to another similar projects in the Czech Republic, compare platforms they work on and the providers

Based on the gained knowledge, the author will make a final evaluation of IZIP and to suggest further development.

Methodology of the thesis will be based on study of publications connected with the topic. The practical part will be focused on analysis of the topic and comparing system features with different alternatives. Possible interview with the service provider is not excluded. Based on the interview, two system solutions using use case diagrams will be proposed. As the outcome of above mentioned methodologies, the conclusion will be formulated.

3 Literature review

3.1 E - Government

eGovernment is an interaction between between the government and general public or also within different governments.

"**The term "e-government" focuses on the use of new information and communication technologies (ICTs) by governments as applied to the full range of government functions. In particular, the networking potential offered by the Internet and related technologies has the potential to transform the structures and operation of government**"

(OECD, 2002)

eGovernment consists of informative part, for exchanging information, communicative for communication between the citizen and government and from the transactional part, for transaction of concrete data. (Austrian Federal Chancellery, 2014)

The main goal of each system is to enable the communication between doctors and patients. That means that eHealth is one of the form of eGovernment.

3.2 eHealth

Term eHealth has been around since the end 1990's, with the popularization of the internet. eHealth connects health or medicine, its records and information and the internet and information technologies to carry the medical records between the service providers, doctors and the customers, patience. The exact definition is unclear, but could be as follows:

"**A new term needed to describe the combined use of electronic communication and information technology in the health sector. The use in the health sector of digital data – transmitted, stored and retrieved electronically – for clinical, educational and administrative purposes, both at the local site and at a distance**" (Eysenbach, 2001)

Previous definition is not definitely recent, despite it clearly shows the main purpose of eHealth.

According to early studies[1] of this topic, we can divide eHealth into 10 E's.

Efficiency – Simply decrease the cost of health care by increasing the communication between doctors and patient to avoid unnecessary diagnostics.

Enhancing quality – Decreasing does not mean also decreasing quality. Enhance the quality of health care by giving a chance to customer to choose between different eHealth providers

Evidence based – interventions should be scientifically proven, not assumed. That requires team of well skilled people.

Empowerment of patients - all the information given by the providers should formed so even amateurs would be able to understand the content

Encouragement – relationship between the customers and professionals should be in good manners

Education – Educating and extending the knowledge of health professionals as well as the patients

Enabling – standard way how to provide and exchange the information between two parties

Ethics – content of the information, should be private and well formed

Equity – One of the biggest goals of the eHealth. Decreasing the gap between generations, skilled and unskilled so everybody will be able to use such technology. That is not only a problem of eHealth, but information technologies generally.

3.2.1 eHealth in the Czech Republic

The main institutions which are determining which way will be the eHealth heading is National plan of eHealth development[2] established by the Czech national forum for eHealth and the ICT Union. These institutions are cooperating with the ministry of health.

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[1] *http://www.jmir.org/2001/2/e20/*

In 2012 Ministry of health of the Czech Republic held a seminar[3] about the electrification of the Czech healthcare. They have shown a concrete vison, which should be followed in the near future. The main purpose of the seminar was to end the theoretical discussion and start the real planning and get inspired by the other European countries. The main idea is to build up on already working systems, which are used by the doctors and the staff. Electrification should be done by professionals in charge, different teams should be working on standardization, legislation, technical solution, economics and statistics, etc.

3.2.2 Czech Republic's strategy for eHealth

In 2012, Czech Ministry for health together with the Czech branch of WHO has published a study[4] to show a plan and goals, how should Czech Republic proceed in creating a suitable environment for eHealth.

This document was written at the Tromso university in Norway, by the experts Per Urland Hasvold and Udine Knarvik. The strategy they have proposed, is to follow so called Three-phase approach with following scheme:

1. Phase 1: Platform Establishment

1.1 Work group Establishment and its mandate

1.2 Evaluate already existing problems of health

1.3 Stakeholders analysis and define their contribution

1.4 Summarize infrastructure and information systems

1.5 Establish mechanisms with common base (workshops and seminars)

1.6 Common vision for eHealth

2. Phase 2

2.1 Determine short and long term goals

2.2 Determine specific milestones

2.3 Specify roles and outputs for each stakeholder

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[2] *Národní plán rozvoje E – Health*
[3] *Available at http://www.mzcr.cz/dokumenty/ministerstvo-zdravotnictvi-dnes-usporadalo-diskusni-seminar-„vytvorme-hospodarny_6412_114_1.html*
[4] *http://www.mzcr.cz/Soubor.ashx?souborID=15026&typ=application/pdf&nazev=*

3. Phase 3

3.1 Identify tools and pointers which will be used for measuring the course and results of eHealth implementation

3.2 Initiate research projects which will watch over the implementation processes to identify and evaluate incurred problems and successes.

The main goal was to create a bulk of recommendations to create eHealth in the Czech Republic based on documents regarding eHealth in Norway, Denmark, Canada and Israel.

(Ministerstvo zdravotnictví České republiky, 2012)

3.2.3 Legislation

Early concepts focused on eHealth in the Czech Republic came in the late 90's, yet none of them is still fully working and is supported by the Czech government.

History of E- health is closely related on the political climate connected with the ministers for health. One of the first important steps was the amendment to the Act in 2001. Later on, how the ministers were changing, their points of view and concepts as well. While some ministers were supporting eHealth (Marie Součková, Jozef Kubínyi), others were against it. Example of that can be very controversial figure, David Rath. During his position as a Minister of health, he was strongly fighting against the insurance company VZP which was financing the IZIP project. He was trying to cut off IZIP from VZP money. Between 2010-2013 when Leoš Heger was in the office, Czech E – health did not enjoy its prosperity too, due to luck of trust and the fear of loosing important personal data. Because all of these changes and not continuity is eHealth slowly growing.

The change of the legislation is necessary. In the Czech Republic is currently several projects which are still looking for the support from general public and proper legislation. IZIP, Health registers, eNeschopenka, ePrescription, ePACS (system for exchanging visual documentation, successfully used by several hospitals). Results from the analysis

completed by the Czech company Restart[5] the main problem with eHealth implementation in Czech Republic is a difficult legal environment, personal data protection, bad communication between each interested groups and missing legal obligation to use eHealth. The last point is the most important one for the successful implementation.

(Soukupová, 2012)

3.2.4 eHealth service structure

Generally E – Health tools must contain an internet portal, so both the doctors and patients can access their records from their computers, mobiles, tablets etc., already mentioned information about their medical conditions, e-mail portal, properly secured, so both included sides can exchange messages, monitoring devices. Nowadays since smart phone became a small personal computer in almost everybody's pocket, apps are being part of almost every E – Health service provider. To get E – health understandable for the users, there are internet based brochures and recourses for patient self education. It also helps to improve the communication between both sides.

One of the main pillars of the 21st century medicine is that the health system must be effective, high-performing and high-quality.

3.2.5 Electronic medical report and other Czech and European projects

3.2.5.1 Electronic medical report

Electronic medical report[6] is an eHealth project by the Czech insurance company VZP and company IZIP, a Czech ICT company. It was established in 2001 and in 2004 the project started working and was supported by the Czech government. In 2012 was the project by the government stopped. The reason for it was that the doctors did not use it as it

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[5]   *In 2012, Company Restart summarized the Czech eHealth situation in their analysis called Restart – 10 let českého eHealth*
[6] *Elektronická zdravotní knížka*

was needed. The price of the whole project was 2 billion CZK. In 2013 VZP decided to give 72 million CZK yearly so the project will be still functioning[7].

IZIP gathers patient's information in an electronic form which is non-stop accessible by the users. The main purpose is to exchange the information between the patient and doctors or as well between the doctors. Patients can consult their health conditions with the doctors, agree on a medical treatment or agree on personal appointment. With the patient's agreement doctors can edit and upgrade the information.

Whole service is for free only for the VZP customers, other insurance company's users need to pay for it.

According to the official IZIP webpage, system is currently using 2 556 451 people, 20 968 medical workers and 8 631 medical centers.

In June 2015, VZP after 12 years terminated the contract with the company IZIP. VZP wants to activate their own project, called VZP Point. According to the IZIP website, the project is suspended at the period starting from 1.1.2016 to 3 months. During the period of suspension all data and information will be secured. (IZIP, a.s., 2016)

3.2.5.2 eNeschopenka

Dealing with sick notes in the Czech Republic is quite an obsolete process. Patient has to bring 5 papers to the doctor, and he or she has to go through all of them. This takes several minutes and with full waiting room of patience the time growth is exponential.

Project of Czech Social Security Administration[8] who pays off certain amount of money during the sick leave, eNeschopenka allows doctors to send reports about the origins, regime change and termination of temporary incapacity electronically, via the Internet. This should bring less administration to the process and reduction of cost and also time spent with filling the papers. However, current public statement is not really promising for this project, physicians argue that eNeschopenka would bring more harm than benefits. One of the reasons why, is because now doctors receive forms which they need to hand to

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[7] *http://www.rozhlas.cz/radiozurnal/dvacetminut/_zprava/1074847*
[8] *Česká správa sociálního zabezpečení, CSSZ*

patients directly from CSSZ. With eNeschopenka, they would have to print the forms at their own expense. Also to be able to print out forms for patients, computer, software, printer and toner is needed.

It seems that until such project won't be recognized by the government it does not have any future. Doctors are not happy with spending their own money in a project that they do not truly believe in.

(Česká správa sociálního zabezbečení, 2016)

3.2.5.3 ePreskripce

ePreskripce, also known as eRecept is well known part of eHealth, which is working in many different countries across the whole world. Instead of regular paper prescription, which doctors hand over to their patients, they receive their ePrescription to the cell phone via E − mail or SMS. With received SMS code, patient's code can be identified by the pharmacist. Based on the code and insurance card pharmacist knows, which and how many drugs should be given to the patient. When SMS code is used, it immediately becomes invalid.

The organization, which stands behind ePrescription in the Czech Republic is the State Institute for Drug Control[9] . The main idea is to have complete control over medicaments usage and prescription, which helps to avoid illegal purchases of prescriptive drugs and it's use. Every ePrescription is sent to the central repository. Once central the repository receives the prescription, they send back the SMS code.

Following picture shows the exact lifecycle of an ePrescription.

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[9] *Státní ústav pro kontrolu léčiv, SUKL*
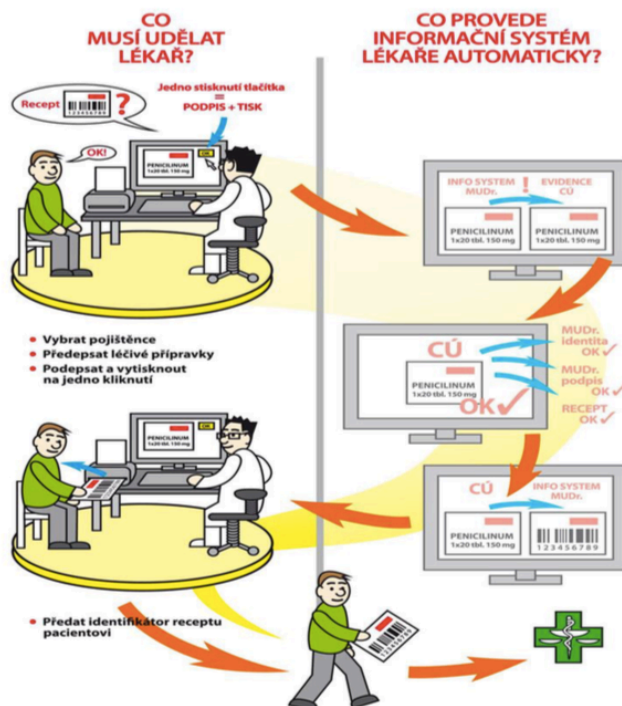
Figure 1: ePrescription cycle, (Státní útvar pro kontrolu léčiv, 2008)

According to SUKL, the biggest advantages are:

- ePrescription is not possible to fill out incorrectly
- ePrescription increases patient safety
- makes job easier both for doctors and pharmacists
- it us a prerequisite for successful computerization of health care, thereby increasing the efficiency of the entire system

  (Státní útvar pro kontrolu léčiv, 2008)

While pharmacists quite welcome such approach, which would speed up their work, conservative Czech physicians do not. Their biggest concern that around 20% of all doctors would be threatened, because they do not even have a computer or internet connection. There is an equipment which is necessary to for ePrescription. The investment they would have to make is not so enormous.

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[10] *The picture describes the process of giving the ePrescription. Doctor signs the prescription with his digital signature, the system checks and authorizes it and generates an unique bar code which is assigned to the ePrescription. Doctor then prints the prescription and hands over to the patient.*

ePrescription was close to enactment. In 2013, House of Commons appointed a new amendment to the act, where ePrescription supposed to be obligatory form 1.1.2015. Now, Ministry of health wants ePrescritpion to be postponed, or cancelled. This problem is common in all eHealth projects in the Czech Republic. If all these projects were enacted by the government, the situation would be different and even Czech Republic could have functional eHealth system as other western countries.

3.2.5.4 epSOS

epSOS, European Partners Smart Open Services, was a multinational eHealth project, which governed electronic health record systems in Europe. The project was financed by the ICT Policy Support Programme, a part of European Commission.

Main goals of the project were to improve quality and safety for international travelers across the whole Europe. Each participating country had their eHealth system involved, providing access to patients health information, including documentation about prescribed medicines, reducing errors of wrongly given pills by the foreign medical stuff.

Together with the Czech republic, there were 25 countries participating in the epSOS project. Czech republic was providing to the Electronic medical report project, created by IZIP. Czech Republic has left epSOS in 2012, when the Czech government stopped supporting the IZIP project.

According to the information from the official epSOS website, the project was in working in the period of 2008 to 2014. The price was 36, 5 millions of Euros.

(Swedish Association of Local Authorities and Regions, 2014)

3.2.6 Data Standards

Data standards are part of electronic data exchange, which are generally used for communication, data exchange, data sharing and integration between interested parties. In

the Czech Republic there is quite a lot of different data standards, but the most important ones are DASTA, Data Standard of Ministry of Health[11] and HL7, Health Level 7.

3.2.6.1 DASTA

DASTA is a data standard for data transmission between information systems in healthcare facilities. The first version was created in 1997 and since 2002, DASTA is used by most of the eHealth systems across the Czech Republic.

It is a regularly updated, open standard for communication between systems, medical equipment, which covers the areas of clinical, laboratory, statistical and administrative. Documents are transferred XML and XML scheme file.

There are two versions of DASTA currently available, DS3 and DS4. The first version is mainly used to transmit basic types of records on the implementation of two-way communication with laboratory information system and possibly RTG. DS4 extends the functionality of DS3 by adding clinical events and it's practical development, such as laboratory tests, X-ray, receiving patient, surgery reports and more. Not only that DASTA contains blocks for the transfer of patient's data, but also blocks for examination of drinking water, laboratory manuals and more. DASTA mainly focuses on:

- Identification of patient's data
- Basic patient's information (address, date of birth, weight, height, etc.)
- Urgent information (Allergies)
- Payments, insurance, sick leave notes
- Medical history
- Medicines
- Vaccination
- Clinical events such as orders, results, reports (laboratory, X-ray, many types of documentation, special checkups according to the code of clinical events.)
   (DASTA - sdružení pro podporu a rozvoj standardů elektronického zdravotnictví, o. s., 2012)

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[11] *Datový standard Ministerstva Zdravotnictví (in Czech)*

3.2.6.2 Health level 7

HL7 is a non-profitable organization which was formed in 1987, standard developing organization which is providing standards for eHealth data exchange. According to the official webpage, HL7 is supported by more than 1600 members, from over 50 countries, including healthcare providers, government stakeholders, pharmaceutical companies, consulting companies. While DASTA is focused only on the Czech market, HL7 is widespread worldwide.

Same as the organization, HL7 is also the name for the data standard. It is the world's most used standard for the exchange, integration, sharing and retrieval of electronic health information.

*"***Level Seven" refers to the seventh level of the International Organization for Standardization (ISO) seven-layer communications model for Open Systems Interconnection (OSI) - the application level. The application level interfaces directly to and performs common application services for the application processes. Although other protocols have largely superseded it, the OSI model remains valuable as a place to begin the study of network architecture***"*.

 (Health Level Seven International, 2007)

HL7 standards define how medial documents will be transferred within the interested facilities. They set the language, structure and data type types required for the integration between systems[12].

3.2.7 Barriers and challenges

To run a successful eHealth in any country, many goals has to be fulfilled before the start. Principle of eHhealth and telemedicine is that critical number number of users and content must be set, so the service has some useful value. For reaching the critical number of users is necessary to convince somebody, who will create the value of the

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[12] *www.hl7.org/standards*

service and will be the early user. This is complicated because there is no certainty that the service will be successful. All the effort given into it would come idle.

The biggest problem and the biggest obstacle as well is the legislation process and the government support. The change of the amendment to the Law 20/1966 Sb. is necessary. Czech government still sees that our country needs to follow modern trends. The latest important movement concerning Czech E-government was announcing of a public tender by the Ministry of Health of the Czech Republic during September 2012.

Jury of 11 specialist in eHealth field chose 1 candidate out of 9 which was Microsoft s.r.o.. The goal is to create an acceptable concept of relevant Czech eHealth system. The main points are:

- National politics, legislation and standards
- Electronic medical documentation
- Electronic patient identification and medical staff
- Medical information site
- Electronic educational system for medical staff and patients

Since then nothing significant has happened. Up to this date, Microsoft has not came up with any working system and even any concrete idea. Because of that, ministry of health postponed plans for changing the eHealth indefinitely. Recent significant movement is memorandum from 2014. This document is promising to unite professionals such as doctors and medical staff to create a concept and even specific projects, establish cooperation with ministry for health. This was announced on the conference called Internet in Public Administration. New concept of electronic health for the period 2014 + *(Nová koncepce elektronického zdravotnictví pro období 2014 +)* is discussing the increase of quality, effectivity, expediency and also financing of electronic health system. The main prerequisite to meet those objectives for development of eHealth is to follow these basic rules:

- Setting standards necessary for the development and long-term sustainability of E – health and supervise their implementation

- Systematically promote computerization in the health sector in order to encourage both patients and providers to implement and use new processes, systems and applications to enable the correct setting of decision-making processes
- Keep sensitive personal and medical data under control and provide a clearly identified entities
- Develop and enforce eHealth strategy

(Phillip, 2014)

Czech Republic is facing many challenges and barriers in terms of eHealth. Luck of trust, due to many political and financial problems and scandals, including the IZIP project. There are also concerns from the users. The biggest worries are about the safety of the whole system, such as data leaks which is not unusual nowadays. Doctors and the health personal are complaining that they they are also not being well informed about the whole process. On the other hand, eHealth should simplify doctors administrative part of their work and should reduce their time spent with the "paper work". Patients, especially the older generations are demotivated to use E-health, mainly because they would have to learn a new technology.

3.2.7.1 E – health usage by general practitioners

When creating a strategy plan for electronic health in any country, European Union is playing a very important role with their statistical researches. Very important one, which shows current progress among all European countries is so called "Benchmarking deployment of eHealth among General Practitioners" by European commission published firstly in 2008 and it's second version in 2013. This study focuses on on basic infrastructure in information and communication technologies – computer and internet connection - among general practitioners (GPs). These studies show actual image and progress regarding the usage and future possibility of use of E – health across the EU countries.

In the study from 2008 is visible that 87% of GPs used computer in their offices but with large differences between all of the studied countries. Highlighted Czech Republic, with it's 82%.

Table 1: Comparison of countries by computer usage in GP's offices (European Commission, 2008)
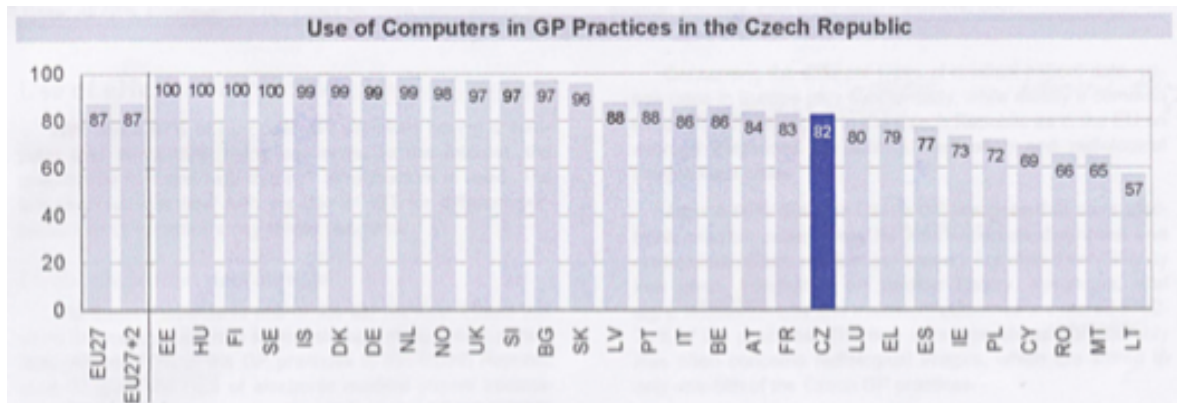
Next picture shows using the internet in GP's offices in a year 2008 which is significantly less than using just computers.

Table 2: Comparison of countries by internet usage in GP's offices (European Commission, 2008)
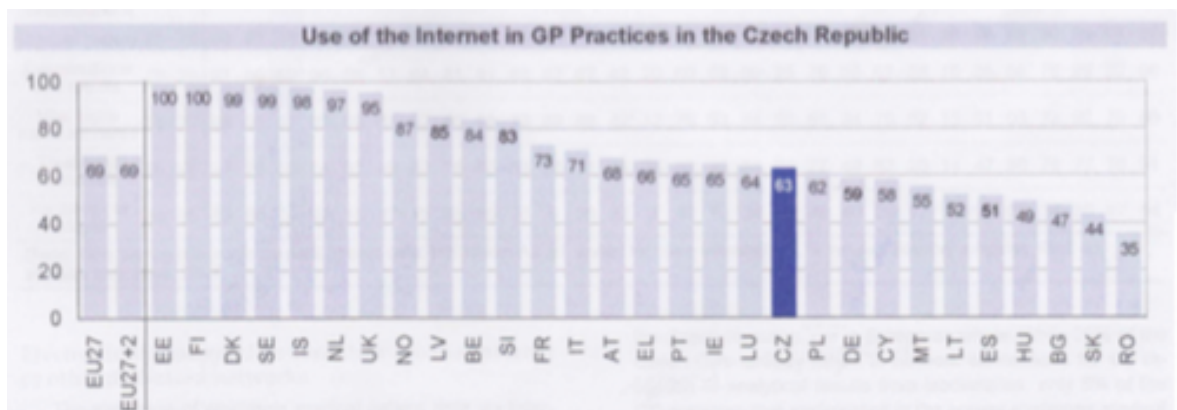
The basic infrastructure was and still is quite developed. Although, using some kind of E – Health system is not that common.

 (European Commission, 2008)

With the new survey from 2013 many graphs disappeared, such as two previous mentioned. Using a computer and internet connection in hospitals and doctor's offices has become a standard. Although, previous data has been taken into consideration and many new graphs has been created with direct comparison with the previous survey.

In the last survey, new method for showing the data has been used. The scale is represented by numbers 0 to 5, where 0 = 0%, 1 = 20%, 2 = 40%, 3 = 60%, 4 = 80 %, and 5 = 100%.

 (Lupiañez-Villanueva, 2013)

Table 3: Comparison of Countries by eHealth growth (Lupiañez-Villanueva, 2013)
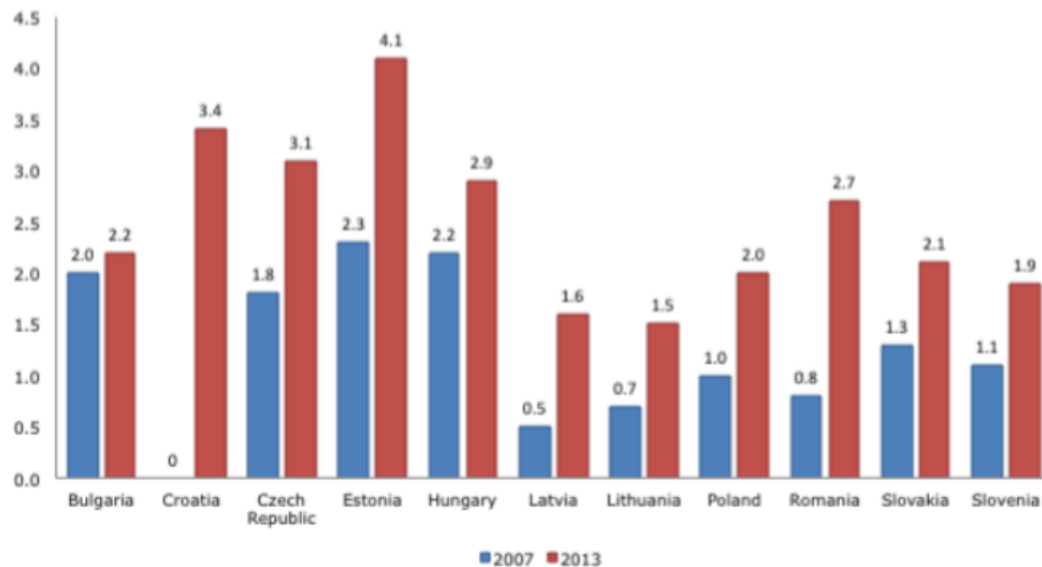
As above mentioned table shows, usage of eHealth in some countries nearly doubled. Still, gaps within different countries is quite large. Czech Republic has done quite a big progress. From around 30% usage of eHealth among GP's the growth has gone to little bit over 60 %. Still, Czech Republic is below the average in overall usage of eHealth systems. It does not necessarily mean that when doctors have computers in their office that they use or run some kind of eHealth program which is used for direct interaction with patients.

Electronic medical report is a very individual matter. It is hard to look for certain models, but the economical situation is an important factor for precociousness of eHealth in any country. Even thought Czech Republic has done quite a big progress in recent years, due to any non-obligatory system.

4 Practical part

4.1 Comparison of eHealth tools among Czech insurance companies

This chapter will focus on comparison of eHealth tools, which are provided across the Czech insurance companies. For the comparison, 4 system and services were chosen.

Electronic medical report was previously described in the chapter 3.2.5.1.. Today, the system is no longer in use after VZP is no longer financing the company IZIP. Even though EMR is currently suspended, it was the most promising project ever done within the Czech Republic boarders, it was one of a few pure eHealth systems. From the comparing systems, this one is the only eHealth project, the rest have similar functionality though. (IZIP, a.s., 2016)

VZP Point is a successor of a previous insurance portal, Portál VZP. The predecessor was run same as the EMR by the company IZIP and after VZP stopped financing IZIP, they developed their own portal. The functionality is really broad. The main purpose is to ease the communication between the user (Doctors, Medical Facilities, Employers, Self-employed, etc.) and the insurance company and to have an overview about spent money on social and health insurance. (Pojišťovna VZP, a.s., 2015)

VITAKARTA is a project by the Czech insurance company OZP. It is an online free application, which offers similar services as the previously mentioned product. But as a bonus, it also provides a free smart phone application, available on all platforms, where the user (patient) can keep his or her own diary with all the important records regarding health (medical checkups, vaccinations, etc.), assistant services and it also works as a medical card, same as the regular plastic one. (OZP, 2015)

Portál ZP has the same functions as all the above mentioned portals, but is different at the same time. Portál ZP is provided by 5 Czech insurance companies, OZP, which is mentioned above but Vitakarta is not a part of it, Česká zdravotní průmyslová pojišťovna, Zaměstnanecká pojišťovna Škoda, Revírní bratrská pokladna, Vojenská zdravotní pojišťovna České republiky and an ICT company, Asseco Central Europe, a.s.. Users can communicate through the Portal ZP with their own insurance companies and have an access to all information about their payments and insurance information.

The first table shows on which platforms can the users communicate.

Table 4: Comparison of insurance system by the interface

Projects	WEB	APPS	Email	SMS
IZIP – EMR[13]	YES	YES	YES	NO
VZP Point	YES	NO	NO	NO
VITAKARTA	YES	YES	YES	NO
Portál ZP	YES	NO	NO	NO

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[13] *IZIP was suspended at the time of creation the comparison. Still, as the only example of real eHealth system, electronic medical report was selected to be a part of the compared systems.*

The second table shows who inserts the data into the system, who is the target user, who operates the whole process, who funds the projects and when it started and finished.

Table 5: Comparison of Insurance systems

Projects	Data Insertion	Target User	Operator	Owner	Funding	Started On	Finished On
IZIP-EMR	Doctor/ Patient	Doctor/ Patient	IZIP	VZP/ Private owner*[14]	VZP/ Private owner	2004	2012; 2015*[15]
VZP Point	Insurance Company/ Med. Facilities/ Employer/ Institution	Doctors/ Hospitals / Employer	VZP	VZP	VZP	2015	In Use
VITAKARTA	Patient	Patient/ Doctor	OZP	OZP	OZP	2011	In Use
Portál ZP	Insurance Company/ Med. Facilities/ Employer/ Institution	Doctors/ Hospitals / Employer	*[16]	*[17]	*[18]	2002	In Use

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[14] *Minority owner is a Swiss company eHl eHealth*

[15] *Insurance company VZP stopped financially supporting IZIP in 2015, also sold their share.*

[16] *Portál ZP is operated by more insurance companies (OZP, CZZP, VZPCR, ZPS, RBP and Asseco company)*

[17] *Portál ZP is owned by more insurance companies (OZP, CZZP, VZPCR, ZPS, RBP and Asseco company)*

[18] *Portál ZP is financed by more insurance companies (OZP, CZZP, VZPCR, ZPS, RBP and Asseco company)*

4.2 Interview

To determine barriers, gaps, current status, future of eHealth, but also specific projects in the Czech Republic and elsewhere, an interview with Mr. Němec was set up. The main goal of the interview was, based on the answered questions, to come up with a solution of a new eHealth system, which is missing on the Czech Republic market.

Mr. Lukáš Němec currently works as Solution Architect in the insurance company VZP, which was financing the Electronic Medical Report project, created by the company IZIP. Before he transferred to VZP, he worked on the Electronic Medical Report project himself.

First questions were discussing the current eHealth situation in the Czech Republic. According to Mr. Němec, current situation is facing many obstacles. The first one he mentioned is politically based. Unstable political system and often changing environment causes disparity of all eHealth systems. Second problem is related to the first one. Mr. Němec mentioned the standardization of documents. Czech Republic uses many standards and it is not exactly stated which one should be used. This is causing that participating sides do not have to understand each other. Czech ministry of health supports and contributes on data standard, DASTA – Data standard for data transmission between information systems in healthcare facilities. It is a XML format file, which tells how should each documents sent look. Each document contains important patient's information, such as medical history, diagnosis, laboratory examination. This is one of the standards, but not fully supported by every facility and systems.

Next part of the interview was focused on the biggest gaps in the current eHealth systems. Mr. Němec stated that the largest problem is that in the Czech Republic is not any fully working system. Most of the systems which can be found here are only locally based. Several hospitals have their own systems. They keep patient's records throughout departments, but when the patient transfers to a different medical center, all the data are lost. This sets that the connection within more medical facilities is very poor.

In the last part of the interview Mr. Němec mentioned common problems and annoyances when patients visit their doctor. The process is usually really slow and the waiting room are full of people. It is really often problem of disfluency and misunderstanding between the physicians and their patients. Mr. Němec pointed to people who come in to the doctor's office and sometimes even do not remember which medicines they take. He proposed and

recommended solutions which he knows from abroad, but do not work in the Czech Republic.

4.2.1 Gap analysis

Based on the interview, main gaps in the Czech Republic's eHealth systems were determined. As already mentioned in the previous chapter, the main problem is that there is no eHealth system, which would be interconnected with medical facilities nationwide. Czech Republic had a few promising eHealth projects, such as Electronic medical report by IZIP, ePreskripce and also epSOS, all of them described in chapter 3.2.5. All of these system indicates that there the basic infrastructure is already determined. Data from unsuccessful projects could be used to the new ones. Central repository form ePreskripce, Patient's data from Electronic medical report, epSOS for the interconnection behind the Czech boarders, all of them have a very large potential and should be used for further development.

4.3 Solution 1

Mobile support system for ambulances is not very developed in the Czech Republic. Some of the Czech regions started using system called eMeDocS[19] . Exchange Medical Document System builds, maintains and expands the communication infrastructure between healthcare facilities within the health system in the Czech Republic. It allows fast documents exchange in purpose to give the patient the exact care he or she needs. This project works only on regional bases.

To create more effective mobile support system for ambulances, Czech Republic has to motivate all participating sides, starting with general practitioners, to contribute in nationwide system. Such project would bring many benefits, especially speeding up and ensuring the process of outpatient treatment.

Whole cycle would start in general practitioner's office. Incoming patient would have undergone entrance examination, where his or her physician would input all gained data into the computer. Important part would be to register patient's medical history, including

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[19] *http://www.emedocs.cz/popisprojektu*

all allergies, prescriptive pills, undergone surgeries, shortly anything what could threaten patient's life. This is ordinary process for each general practitioner. The condition, however, would be unconditional record in doctor's computer. Each patient would have their own credentials, full name and date of birth. The next step would be to send each patient's medical history to the central repository, where all records would be stored.

Each ambulance crew would have to be equipped with computer or tablet, pre-installed software and internet connection. Communications node would be installed on the local network of each participant, meaning medical facilities and ambulance cars.

When ambulance would arrive on the scene to rescue or give an appropriate care to the patient, an ambulance crew member would reach for the patient's credentials, by acquiring them from the person's ID card or directly from him or her. The crew member then finds the patient's medical history in the system providing the patient's full name and the date of birth. System then displays the patient's full medical history. Emergency doctor would know which drugs and procedure can or cannot be used.

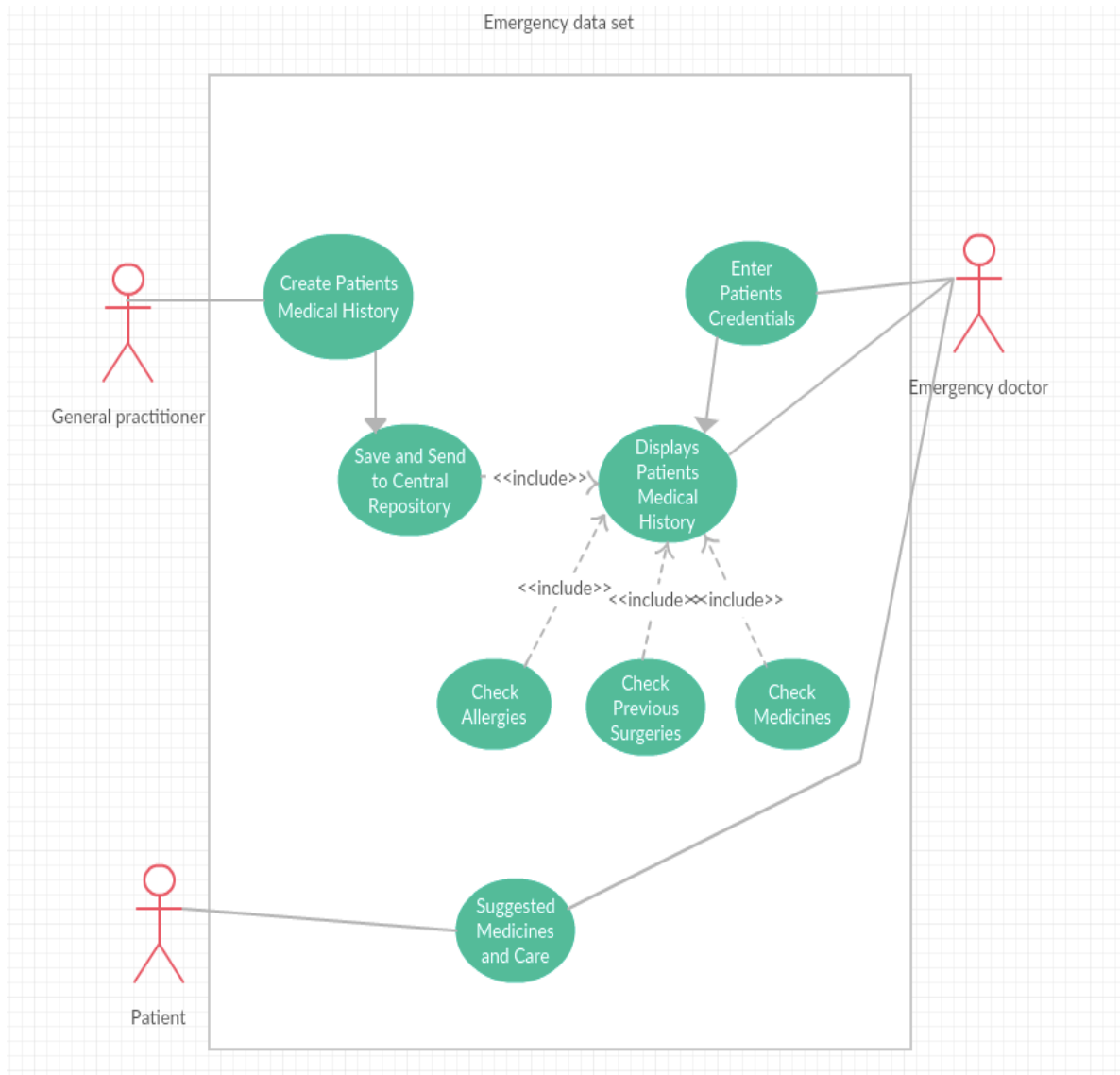Following picture shows the use case diagram of the system.

Figure 2: Use case diagram of Solution 1

4.4 Solution 2

Common problem when older patients come in the doctor's office is that they do not remember their prescribed drugs. It is not an issue when patients come for checkup or for new medicines to their doctor's office. The problem arises when a doctor accepts a new patient and pills for certain illness needs to be prescribed. When the complete medical history is not provided and the patient does not know which medicine he or she takes, in some cases the doctor can prescribe a medicine which should not be combined with the one which the ill person takes.

Principle of keeping prescriptions in electronic form in central repository is known from the project ePrescription, which was described in the chapter 3.2.5.3. System for medication safety could build on it.

As in previous solution, general practitioners would have an important role in this system. Each participating general practitioner would have to create a new medicine record for each of their patient. Each medicine history would be sent to the central repository, where all of the medicine histories would be stored.

When an ill person would come for a medical checkup and new drugs would have to be prescribed, the responsible doctor would have to check the patient's medicine record. If the newly prescribed medicine would not be harmful in combination with the dugs already in use by the patient, the doctor would be able to hand out the prescription. The prescription would be sent to the central repository, as well as the medicine history. Patient would then receive a prescription printed out from the doctor's printer, with a unique bar code.

The last part of the cycle would when the patient would pick up their medicine. With received prescription, patient would come to the pharmacy, where he or she would hand over the prescription to the pharmacist. The pharmacist would then check the validity of the prescription in the central repository and if the match would be successful, the pharmacist would be able to issue the medicine to the patient.

The following picture shows the use case diagram of the whole system.
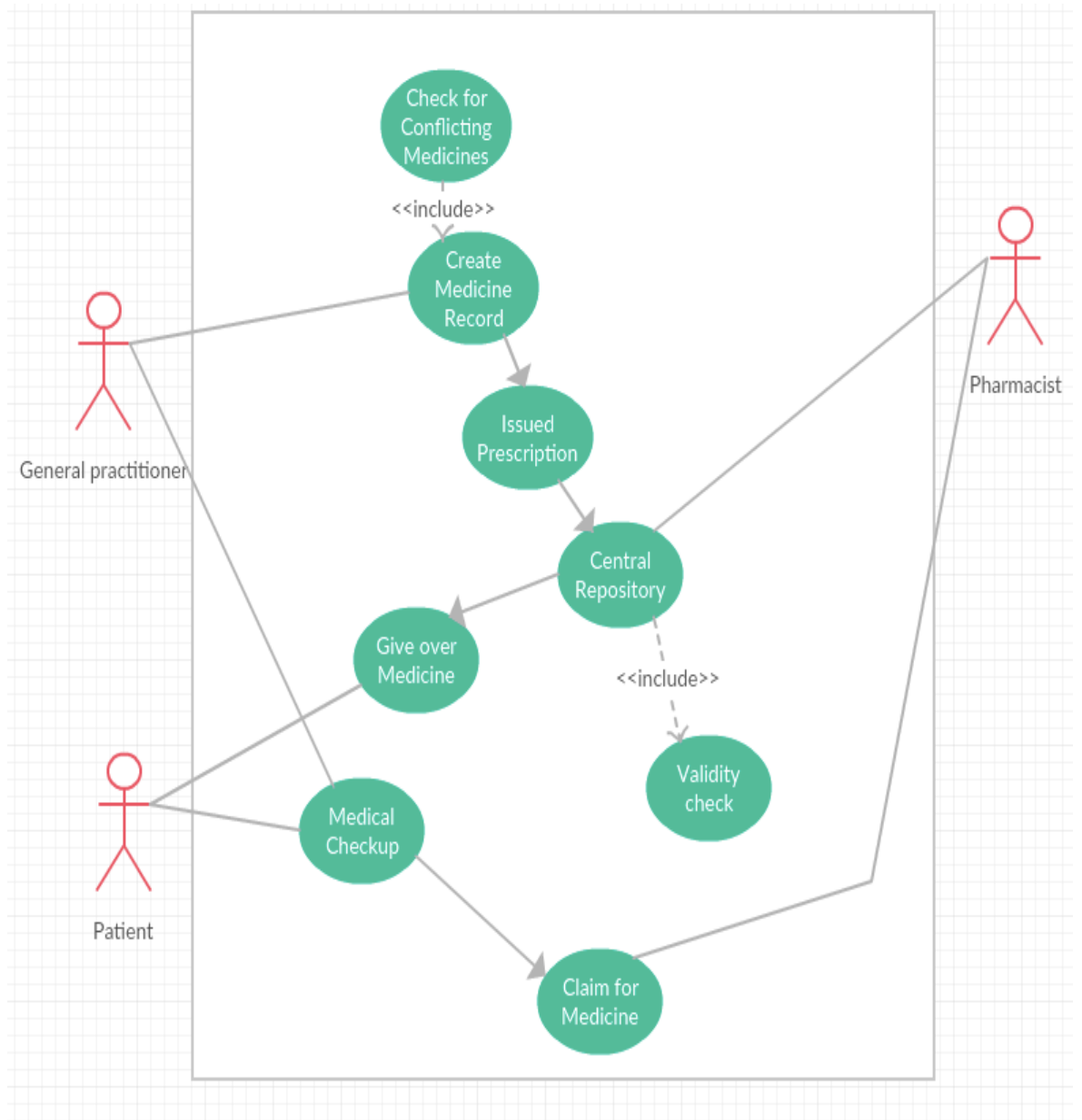
Figure 3: Use case diagram of Solution 2

These two solutions were created as use case diagrams, which shows the the user's interaction with system.

4.5 SWOT analysis

In this chapter, SWOT analysis will be used to determine strength, weaknesses, opportunities and threats for both solutions together which was presented above.

Table 6: SWOT analysis of proposed solutions

Strength	Weaknesses
Interconnection within medical facilities	Low level of already existing eHealth systems
Already existing data	Demand for eHealth systems in the Czech Republic
Easy access to the medical history	Failure to meet the existing plans and tasks in Czech eHealth
Support of EU and EC	Not united data standards
Opportunities	**Threats**
Increase citizen's interest for their health	Lack of willingness of doctors
Creating newer and better systems for medical facilities	Low Czech government support
Connection within more European countries	Computer illiteracy of older generations

4.5.1 Strengths

As above mentioned table shows, the biggest strengths of proposed solutions are the interconnections within medical facilities. This would ensure that each patient gets

appropriate care even when switching from one doctor to another. In the Czech Republic were already many attempts for creating eHealth systems, so there is already an infrastructure for the new systems, such as data from the Electronic Medical Report, or central repositories from ePreskripce. Doctors would also have easy access to the patient's medical history. From many surveys done by the European Commission and World Health Organization (Lupiañez-Villanueva, 2013) (European Commission, 2008), it is clear that they support development of eHealth in each country.

4.5.2 Weaknesses

Even though there were a few eHealth projects in the Czech Republic, almost none of them is now working. Demand is not very large, there are still concerns about eHealth, due to not really good reputation. There has been a number of failures to meet the existing plans and tasks in the Czech Republic. Strategies and plans are developed, but only a few projects went to the pilot phase. As already mentioned in the chapter 3.2.6., there is not one data standard which would be ordered to use.

4.5.3 Opportunities

eHealth generally offers opportunities. It should increase people's interest for their health conditions, to have an overview about their health. Also, too many medical facilities still use old programs and systems. eHealth solutions would force to replace these with newer, compatible systems. As epSOS project showed, it is great to have eHealth systems connected within different European countries. Treatment of the patient, who is abroad is much safer and easier, when there is an access to the medical history.

4.5.4 Threats

Willingness of doctors to have some kind of eHealth systems is not quite large. They often complain about the price they would have to pay to equip their offices. In the Czech Republic, computer literacy is not very high. According to the research by association STEM/MARK, 86% of seniors older than 60 years were computer illiterate.

This research is 10 years old. More recent study by the Czech statistical office shows[20] that the number nearly doubled. Czech government supports eHeath in a way of creating plans and strategies, but any large step since IZIP was not done.

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[20] https://www.czso.cz/documents/10180/24154477/97011115.pdf/dcd16d7d-b8ae-434e-9b07-c659d5acc2d7?version=1.0

5 Discussion and results

This chapter provides an example of well working system in Denmark, MedCom. By its structure it is similar to the electronic medical report. It can provide an overview, where could have the IZIP project gone. Also the final discussion about the IZIP and proposed solutions is contained in this chapter.

There is many successful project across the whole Europe. Elektronische Gesundheitskarte[21] in Germany which is an insurance card with a photography and an electronic chip which contains obligatory patient's data. The doctor can read prescribed medicines and patient's medical history from that card.

5.1 MedCom

Denmark can be a great example of how to handle eHealth in their country. With full government support and long eHealth development history which is dating since the late 1980's, they created perfect environment for successful eHealth system called MedCom.

MedCom was established in 1994 as a non-profit organization. Throughout the period of more than 20 years, MedCon has developed a strong unshakable position in the country's eHealth environment. This system enables participating sides to communicate, exchange information and documents. It eases the work to health care providers, mostly to general practitioners by the quick data transfer and reduction of administration costs. MedCom also sets and develops all data standards regarding exchange of health care related data throughout the whole Danish health care. MedCon is also responsible for testing,   labeling and certification of all new eHealth systems in the Denmark market. It is a part of several international eHealth projects, such as universAAL, Antilope, Persona and more.

According to the official website, MedCon have never had any scandal during it's lifetime, which often goes along with IT projects.

Together with MedCom Denmark also runs a portal sundhed.dk. The Internet portal was established in 2003 and it offers following functions:

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[21]*https://www.gkv-spitzenverband.de/krankenversicherung/telematik_und_datenaustausch/egk/egk.jsp*

- Doctors have access to patient's record even from different medical facilities (after patient's agreement)
- Doctors can issue prescription for patients with long-term medicine usage, so the patients do not have to come to the doctor's office
- Patients can arrange a meeting with their doctors
  (MedCom, 2015)

5.2 Discussion

For communication between the patient and doctor, the Electronic Medical Report by IZIP is a very unfortunate project. The potential of electronic medical report is quite high, but has not been used in the right way yet. An insufficient government support, not a very good reputation, slow development, all of these aspects are reasons why this project is now suspended. There are many projects in Europe with a similar idea, but the main difference is in the willingness to participate in it. Until the participation in those projects will not be great, supported by the government and general public, success will not be delivered.

Denmark's attitude would be a great example for the Czech eHealth. The idea is similar to the IZIP project. Interconnection of all medical facilities, availability of patient's documents to the registered doctors, open communication between the patients and doctors. IZIP also provided a portal for the insurance company VZP. Electronic Medical Report was also one of a few which offered mobile application and from all the compared insurance portals and services was the only one which represented a real eHealth system. If IZIP would get more government support, electronic medical report could be later connected with ePreskripce, using its central repository or with eNeschopenka. That is the main purpose of eHealth, to have the whole health care connected, standardized as in Denmark.

Proposed solutions in the thesis would also use already prepared platforms, such as the central repository for storing the medicine history together with the ePreskripce, patient's data from electronic medical report. They goal would be to connect and unify all eHealth systems together, creating a working system which could participate in international projects as IZIP already once did.

6 Conclusion

The main goal of the thesis was to propose a solution and compare existing projects. Thesis summarized and gave an overview about eHealth in the Czech Republic, about different Czech and partly European projects. Based on those findings 2 eHealth solutions were provided, which would be appropriate for the Czech environment.

It is clearly visible that eHealth has some serious troubles to be captured in the Czech Republic's environment. It seems, from the number of projects which have failed, that it might not have any future here. But IZIP project has shown that it is possible even in the Czech Republic. IZIP was part of international projects, it had government support, about two and a half million people and medical facilities were using it. It had a very big dataset which could have been easily used in different eHealth projects. Even with this promising background, electronic medical report did not succeed. It looks like an avalanche effect, because almost every project eventually did not succeed. It seems that because of this large failure, Czech public sees any other project as not being trustful, doctors are not motivated to participate, they are not willing to spend their money and time in something, which in the end might not even work.

Despite all the troubles which have already come with eHealth, Czech government, Ministry of health of the Czech Republic, Czech National Union for eHealth but also doctors, patients and general public should embrace themselves and work together, follow strategies, avoid scandals and look up to countries, which were more successful in the eHealth implementation. eHealth mostly brings transparency and facilitation, moreover as the whole electrification.

7 Bibliography

Česká správa sociálního zabezbečení. (2016). *www.cssz.cz*. Retrieved 2016, from http://www.cssz.cz/cz/casopis-narodni-pojisteni/archiv-vydanych-cisel/clanky/informacni-technologie-eneschopenka.htm

Austrian Federal Chancellery. (2014). *https://www.digitales.oesterreich.gv.at*. Retrieved 2015, from https://www.digitales.oesterreich.gv.at/DocView.axd?CobId=56936

DASTA - sdružení pro podporu a rozvoj standardů elektronického zdravotnictví, o. s. (2012). *www.dastacr.cz*. Retrieved 2016, from http://www.dastacr.cz

DASTA - sdružení pro podporu a rozvoj standardů elektronického zdravotnictví, o. s. (2012). *www.dastacr.cz*. Retrieved 2016, from www.dastacr.cz

European Commission. (2008). *Benchmarking ICT use among General Practitioners in Europe*. European Union.

Eysenbach, G. (2001). What is e-health? *Journal of Medical Internet Research* .

Health Level Seven International. (2007). *www.hl7.org*. Retrieved 2016, from http://www.hl7.org/about/index.cfm?ref=nav

Ilona, P. (2012). *Management v ošetřovatelství*. Praha: Grada.

IZIP, a.s. (2016). *www.izip.cz*. Retrieved 2016, from http://www.izip.cz

Lupiañez-Villanueva, C. C. (2013). *Benchmarking Deployment of eHealth among General Practitioners (2013)*. European Commission. European Union .

Mafra, a.s. (Irena Soukupová). (2012). Elektronickému zdravotnictví nepřeje legislativa.

MedCom. (2015). *www.medcom.dk*. Retrieved 2016, from http://medcom.dk/medcom-in-english/about-medcom

Ministerstvo zdravotnictví České republiky. (2012). *www.mzcr.cz*. Retrieved 2016, from http://www.mzcr.cz/Soubor.ashx?souborID=15026&typ=application/pdf&nazev=

OECD. (2002). *www.olis.oecd.org*. Retrieved 2016, from http://www.olis.oecd.org/olis/2001doc.nsf/c5ce8ffa41835d64c125685d005300b0/0b677ed527d35bc0c1256b21004f4b6a/$FILE/JT00118445.PDF

OZP. (2015). *www.ozp.cz*. Retrieved 2016, from http://www.vitakarta.cz

Phillip, T. (2014, 4 7). *Nová koncepce elektronického zdravotnictví pro období 2014 +*. Retrieved 4 7, 2014, from https://www.isss.cz: https://www.isss.cz/archiv/2014/download/prezentace/mzdr_philipp.pdf

Pojišťovna VZP, a.s. (2015). *www.vzp.cz*. Retrieved 2016, from https://www.vzp.cz/e-komunikace/vzp-point

Státní útvar pro kontrolu léčiv. (2008). *www.sukl.cz*. Retrieved 2016, from www.sukl.cz/file/75491_1_1

Státní útvar pro kontrolu léčiv. (2008). *www.sukl.cz*. Retrieved 2016, from http://www.sukl.cz/file/75489_1_1/download/, http://www.sukl.cz/informace-o-vyhodach-

Swedish Association of Local Authorities and Regions. (2014). *www.epsos.eu*. Retrieved 2016, from http://www.epsos.eu/home.html

Von Haldenwang, C. (2004). Electronic Government (E-Government) and Development. *The European Journal of Development Research* .

7.1 Appendix

7.1.1 Questions prepared for the interview

- Future of eHealth in the Czech Republic
- Why did not IZIP succeed
- Barriers in development of eHealth systems
- Final SW, Communication canal
- Data gathering
- Evidence of old data before IZIP creation
- How many people it takes when creating project such was IZIP
- VZP Point
- End users
- Gaps in current systems