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THE PERCEPTION AND EXPECTATIONS FOR ELECTRONIC COMMUNICATION WITH PATIENTS AMONG FAMILY PHYSICIAN PRACTICES

Master's thesis

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PEREARSTIKESKUSTE HOIAK JA OOTUSED ELEKTROONILISE SUHTLUSE OSAS PATSIENTIDEGA

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Author's declaration of originality

I hereby certify that I am the sole author of this thesis. All the used materials, references to the literature and the work of others have been referred to. This thesis has not been presented for examination anywhere else.

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Abstract

The aim of this thesis is to describe the perception and expectations of electronic communication with patients among family physician practices in Estonia.

Internet is already an important health information source and patients' willingness for electronic communication with their physicians is high. There have been reported promising benefits for physician-patients electronic communication which are ought to lower the cost and improve the quality of healthcare. Patient portals are seen as a solution for providing secure and convenient communication between patients and physicians. Estonian national patient portal does not have a functionality of contacting healthcare providers nor inserting personal health data. Recently a new application, e-Perearstikeskus, has been developed for the secure communication of family physician practices and their patients. Currently, the adoption rate of the application is not too remarkable.

Semi-structured interviews with e-Perearstikeskus (e-PAK) users and web-based questionnaire for general practitioners (GP) and family nurses were conducted to gather Estonian primary care workers perception of electronic communication with patients. The interviews showed that all e-PAK users were positive about the option of electronic communication with patients in their work, but mostly afraid about the security of regular e-mail. So the main feature they welcomed about e-PAK was providing a secure channel. E-PAK was found to have high potential to become tool with useful functionalities, but thought to need many improvements to achieve that. 95% of questionnaire respondents indicated that patients can contact their GP practice via e-mail and almost half used e-mail to communicate with their patients daily or most working days. However, the use of electronic communication was not perceived as positive and the concern for data security and extra work burden stood out. The majority of respondents had not heard about e-PAK and many doubted its value. Some of the most important expectations for secure patient portal for GP practices were interoperability with other software, pre-information asked about patient's reason of

contact, its development in cooperation with healthcare workers and portal being free of charge for the practice.

It was concluded that electronic communication is already an important part of everyday work in many Estonian GP practices, but considering the concern for data security and growing workload, a patient portal that addresses those problems can improve the situation. Already existing e-PAK application has the potential to meet those expectations but there is a lot room for improvement. The difficulty of clear business case for electronic solutions in Estonian healthcare market can be a hindering factor for achieving a very fitting and useful tool for the use of GP practices.

This thesis is written in English and is 48 pages long, including 7 chapters, 9 figures and 1 table.

Annotatsioon

Perearstikeskuste hoiak ja ootused elektroonilise suhtluse osas patsientidega

Käesoleva magistritöö eesmärk oli uurida Eesti perearstikeskuste suhtumist ja ootusi elektroonilisse andmevahetusse patsientidega.

Inimesed kasutavad järjest enam internetti, et leida infot tervist puudutavate andmete kohta. Uuringute kohaselt on patsientidel suur huvi suhelda ka tervishoiuteenuste pakkujatega elektroonselt. Lisaks osutab kirjandus, kuidas arsti ja patsiendi elektrooniline suhtlus võiks aidata kaasa tervishoiuteenuse hinna langetamisele ning kvaliteedi tõstmisele. Paljud tervishoiutöötajad pole sellise suhtlusviisi puhul kindlad andmete turvalisuse nõude täitmises ning pelgavad töökoormuse kasvu. Patsiendiportaale peetakse lahenduseks, mis võiksid tagada elektroonse kanali turvalisuse ning mitmeid toiminguid mugavamaks ja lihtsamaks muuta. Eesti patsiendiportaal *Minu e-Tervis* peamine funktsioon on andmete vaatamine, kuid puudub võimalus läbi selle tervishoiutöötajaga kontakteeruda või ise andmeid juurde lisada. Perearst on Eesti tervishoiusüsteemis tavapäraselt esimene kontakt, kelle poole inimene pöördub. Siiani on perearstikeskustega kontakteerumine olnud võimalik kas füüsiliselt kohale minnes, keskuse kõnetundide ajal helistades või vähesemal määral ka e-kirja teel kontakteerudes. Nüüd on loodud uus elektrooniline lahendus e-Perearstikeskus (e-PAK), mis lubab perearstikeskustele ja nende patsientidele turvalist ja mugavat andmevahetust.

Et koguda andmeid perearstikeskuste suhtumise ja ootuste kohta elektroonsele andmevahetusele patsientidega, viidi läbi pool-struktureeritud intervjuud e-PAK kasutajatega ning korraldati elektrooniline küsitlus Eesti perearstide ja pereõdede seas. Intervjueeritavad leidsid, et elektrooniline suhtlus on nende töös olulisel kohal ja positiivse väärtusega. Küll aga oldi mures e-kirjade turvalisuse pärast ning kõige enam hinnatigi e-PAKi puhul turvalise andmevahetuse lubadust. Ülejäänud portaali funktsioone hinnati potentsiaalselt kasulikuks, kui nende kallal veel arengutööd teha.

95% küsimustikule vastanutest kinnitas, et nende keskusesse on võimalik e-kirja teel pöörduda ja peaaegu pooled kasutasid seda suhtlusviisi patsiendiga igapäevaselt või enamikel tööpäevadel. Suurimate muredena e-kirja kasutamisel suhtluseks patsientidega tulid esile turvalisuse küsimus ja töökoormuse suurenemine. e-PAKist polnud enamik vastanutest kuulnud ja paljud kahtlesid, et selline lahendus nende tööle mingit lisaväärtust annaks. Ühtedeks olulistemaks aspektideks turvalist patsientidega suhtlust pakkuva portaali juures peeti ühildumist teiste kasutusel olevate tarkvaradega, patsiendi eelinfo kogumist keskusega kontakti võttes, tervishoiutöötajate kaasamist portaali arengusse ja seda, et keskused saaksid lahendust tasuta kasutada.

Töö kokkuvõttes järeldati, et elektrooniline suhtlus on juba oluline osa igapäevatööst mitmetes Eesti perearstikeskustes. Arvestades tervishoiutöötajate muret andmeturvalisuse ja kasvava töökoormuse pärast, aitaks olukorda paremaks muuta patsiendiportaal, mis pakuks turvalist keskonda ja tööd mugavamaks tegevaid lahendusi. Juba olemasolev e-PAKi rakendus võiks vastavaid ootusi rahuldada, kuid vajab enne mitmeid olulisi arendusi. Selge ärimudel ja majanduslik motivatsioon taoliste lahenduste jaoks Eesti tervishoius võivad saada takistavateks teguriteks tõeliselt mugava ja kasuliku lahenduse väljaarendamisel.

Lõputöö on kirjutatud inglise keeles ning sisaldab teksti 48 leheküljel, 7 peatükki, 9 joonist, ühte tabelit.

List of abbreviations and terms

GP	General Practitioner
e-PAK	e-Perearstikeskus

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1 Introduction

Electronic communication has become a common part of everyday life in the modern society. It is usual for regular people to possess one or several devices providing this way of communication with friends and family but also to receive public or private services. Healthcare is no exception in the field and it is common for doctors to use computer systems for obtaining laboratory or radiology results, submitting prescriptions or asking drug information. Studies show that there is a high demand also among patients to contact their healthcare providers electronically [1, 2].

There is research evidence, how patient-physician electronic communication has potential to improve the quality and efficiency of healthcare service delivery. However, the barriers for the successful implementation of such technologies are primarily not in technical nature but can be described in categories of culture, business case or healthcare structure [1-3].

Healthcare workers are not found to be as enthusiastic about electronic communication with patients as the patients themselves. The concern about data security and additional workload are described as the most significantly factors hindering positive perception [4-7].

Patient portals are seen as a solution to provide secure and convenient patient-physician communication, while also supporting greater patient engagement. Although there are successful examples of such portals with a high adoption rate, many sources report how already developed portals are barely used because of low knowledge and inconvenient user experience [4, 8-13].

In Estonia, a general practitioner (GP) is usually the first contact for persons with health problems. While it is quite common to communicate with GP practices via phone during their office hours, e-mail or other means of communication are not that widely available, even though all practices have computers, internet and use some kind of healthcare software. E-Perearstikeskus (e-PAK) is a new patient portal developed for

GP practices for a secure and convenient communication with patients. However, e-PAK is currently implemented in only four GP practices and has not gained a too high usage. [14-17]. Why this seemingly advantageous software has not obtained wider use was the main motivation of the author to conduct a research on the primary care providers' opinions about electronic communication with their patients.

The initial aim of the current thesis is to describe the perceptions and expectations of electronic communication with patients among the GP practices.

2 Background and context overview of electronic communication between patients and healthcare providers

There is a growing importance of internet as health information source. Although according to some studies many physicians believe that their patients are more interested in face-to-face consultation, it is widely reported that the patients' willingness for electronic communication with the healthcare provider is high. A study conducted among patients from seven European countries found that 4 out of 10 people considered the availability of electronic communication with the healthcare provider important when choosing a new doctor. One study made in a US medicine practice showed that 42% of patients were even willing to pay a small fee to have e-mail access to their physicians [2, 18-20]

Physician-patient e-mail communication has also been found to have promising benefits, including lowering the cost of healthcare and simultaneously maintaining or improving the quality of health promotion and disease management. It has been shown that electronic communication between patients and healthcare providers can potentially save time and therefore have a clinical usefulness. Online messaging systems have been found to be in a correlation with decreased office visits, but have not affected the number of phone calls as the latter guarantees an immediate answer [2, 3].

However, there seems to be a gap between patients' and healthcare provider's interest for electronic communication. When patients would even be open for using Facebook as a medium for contacting their doctors, then healthcare providers seem to face more barriers for entry, including their institutional guidelines, demand on liability and privacy as well as having to alternate current time management [4].

It is discussed that for many physicians tangible evident on service performance and efficiency of electronic communication with the patient is missing, which leaves them prejudiced. Noteworthy is, that although physicians often favour telephone consultations, this way of communication has also no convincing evidence about

making healthcare delivery more efficient. The physicians, who are satisfied with a possibility to electronically communicate with their patients, report it time saving and a way to deliver better care. The others are worried that this would increase the workload. Interestingly, there's also no solid evidence on the increased workload of physicians when using e-mail communication [2, 3, 5].

A study from 2004 explored the attitudes and experiences of e-mail communication with patients within UK general practice by conducting a questionnaire among GPs from Dundee. The study found that the majority of the 62 respondents were concerned about e-mail security when communicating with patients, but the opinion on whether it was a convenient way of communication was divided. Still, having insufficient time to respond the e-mails was a concern for a majority (73%) and more than half of the GPs (58%) thought of an e-mail communication with patients as an additional burden on an already onerous job [6]. A research conducted in Finland in 2016 also underlined information security problems seen as one of the most significantly hindering factors amongst nursing staff for electronic communication with patients [7].

As described, important issues about e-mail communication between physicians and patients are security, privacy, confidentiality. Secure messaging software allowing sending encrypted e-mails and the use of patient portals as secure online websites might be possible responses to deal with the concerns [2]. Confidentiality, integrity and availability are considered as three main components of security by one of the fundamental concepts. Information has to be protected from disclosure to unauthorised parties, it cannot be modified by unauthorised parties and it has to be accessible for authorised parties. Thus, also secure electronic patient portals have to ensure that data will not be compromised in these aspects [8, 21].

Patient portals are generally seen as secure web-based applications that allow patients 24-hour access to their personal medical data, such as information about doctor visits, discharge summaries, medications, immunisations, allergies, lab results. They are recognised as a promising way to support greater patient engagement. Patient portals may also allow secure messaging with healthcare providers, requesting prescription refills, scheduling appointments, updating information, adding personal health information, completing forms, viewing educational materials. From the provider's

point of view, patient portals are a reliable infrastructure that improves communication and provides a one of a kind mechanism to understand patient [8-11].

The largest not-for-profit integrated health delivery system in the United States, Kaiser Permanente implemented a nationwide Electronic Health Record (EHR) with a patient portal called *My Health Manager* between 2004 and 2010. The patient portal has many functionalities, including securely messaging doctors. By the end of 2015 70% of eligible Kaiser Permanente adult patients had registered themselves to use *My Health Manager* and 33% of all primary care physician encounters were made through secure e-mailing function provided by the portal. [22, 23]. Even though studies suggest patient's potential interest for electronic communication with their healthcare provider, as high adoption rate for the services as seen with Kaiser Permanente patient portal are not usual. Huygens *et al* conducted a study in the Netherlands, where many general practices offer such options, and found that the actual use of electronic communication with the healthcare provider was not too frequent, although the intention towards using such service was positive. Lack of awareness was considered to have had an important role in it. Another study from Netherlands among diabetes patients identified that unawareness was the main reason for not using a patient portal. It is also likely that when patients have a chance to use e-mail or even Facebook for contacting healthcare providers, they will continue preferring these convenient options over secure portals, because the features that make portals secure, like additional requirements for log in, also make them inconvenient to use. It has also been suggested that patients are motivated to use online communication with their physicians when also the latter are motivated about this way of communication [4, 12, 13, 24]. One of the important reasons behind Keiser Permanente's success in making so many patients register themselves to the portal has been thought to be good marketing strategy. Engaging patients with features like online bill paying and secure messaging, but also an access to test results as often as possible, has thought to be one way to make patient use the portal continuously [25].

2.1 Situation in Estonia

In a way, electronic communication is very common in Estonian healthcare. Since 2008, a nationwide Electronic Health Record (EHR) enables the exchange of health-related

data between provider information systems and health care sector registries. To register all residents' medical history, it is made obligatory for healthcare providers to forward medical data to EHR. From 2009 residents have access to their data in EHR through a patient portal *Minu e-tervis*. The portal's main function is enabling patients' to view their medical data. Additionally, there is a possibility to use it as expressions of will, by appointing authorised persons to fill digital prescriptions and to notify readiness to donate organs after death or to make health data invisible for doctors. According to the Estonian eHealth Foundation's report from 2015, more than 13% of Estonian population has visited the portal at least once. Although digital registration, a centrally administered system for registering and cancelling appointments with doctors, has been part of the vision for national patient portal's functionalities, it has not yet been implemented. The portal has currently no options for communication with healthcare providers or inserting personal health data [26-30].

The national mandatory health insurance plan is operated by the Estonian Health Insurance Fund and covers about 95% of the population with a board range of services, including the ones from general practitioners (GP). The healthcare delivery system is built around the care provided by GPs who coordinate, manage and authorise all health services provided to a person, that are covered by a certain health plan. Around 800 GP practices with general practitioner's lists of 1200-2000 patients cover the entire population [14]. According to a survey from 2016, 82% of habitants can consult with their GP practice through some mean of communication, mostly phone, but 10% can use e-mail and 2% some other online communication tool (Skype) [15].

GP practices use their own information systems (most commonly Perearst2) to manage patients' medical data and do the accounting of health services. Most of the data is inserted manually to the system and the data exchange with national EHR is not two-way, nor fully automatic [31, 32]. Since 2013 GP practices also have an option for a new physician-physician communication tool provided through EHR *e-konsultatsioon* which enables GPs to consult with specialists about a specific patient's diagnosis and treatment. Information regarding the consultation between two physicians is visible for the patient in *Minu e-tervis*. The service is added to the Estonian Health Insurance Fund (EHIF) list of health-care services and is progressively getting more users. Unlike many other e-health projects that have faded after piloting because of the lack of financing

incentives, *e-konsultatsioon* is thought to have higher success potential thanks to the funding scheme that involves EHIF [33, 34].

Since 2016 there is a new software e-Perearstikeskus (e-PAK) available, facilitating communication between GPs and patients. This year, an application has been made by the Family Physicians Association of Estonia for including the software into its list of health-care services with an aim to provide patients secure and modern tool for the communication with their GP practices [35].

Recently the concern for data security has become more current in the light of European Union intending to provide a set of standardised data protection laws across all the member countries and bringing into force a General Data Protection Regulation (GDPR) on the 25th of May 2018. The regulation aims to give a person greater control over their data. In Estonia the Legal Director of Estonian Data Protection Inspectorate has expressed, that the new regulation compared with current Estonian Personal Data Protection Act is not going to change anything for the healthcare providers concerning the requirements to protect sensitive personal data. However, in his opinion, the promotion and information on the new regulation has made healthcare workers more conscious and aware on the topic. As a response to some GP practices' concern that the new regulation will forbid answering patients' e-mails the Inspectorate has said that the means of communication with patients will not be regulated. But much like with current personal data act, the healthcare workers need to evaluate, whether the content of provided information is not too sensitive for regular e-mail [36-38]

2.2 Overview of e-Perearstikeskus (e-PAK)

E-PAK is a portal made to bring together primary healthcare providers and their patients and is born out of a general practitioner Diana Ingerainen's need for an electronic solution for patient-physician communication. The software is developed by a company Industry62 formerly known as Affecto Estonia with a cofounding from Norway Grants. Alongside with secure messaging possibilities it aims to provide more patient-empowered and prevention orientated healthcare with a functionality of patient's health diary [16, 39, 40].

2.2.1 Initial objectives of e-PAK

The general goal of e-PAK portal, described in the application for Norway Grants, was to make the supplying and receiving of the doctor's services more efficient.

The solution had to enable:

- Mobile Workflow (access in PC-s, laptops, tablets, smart phones)
- Partial replacement of doctor's visits with web based services (involving patient in the process of data gathering and primary analysis)
- New services (self-anamnesis, the report of health arc, decision support etc)
- Additional sources of income for the doctor (by offering paid services)

Services of e-PAK were to be divided as free of charge base services and paid services. The aim of base services was to create active user base and included: Written questions to the doctor; The application for monitoring child's health; Ordering and extension of the health reports and prescriptions; Health card (history of anamnesis complemented by the patient with his general health and lifestyle data); Decision support (application that offers solution for easier health problems and reduces the need for family doctor visits); Self-anamnesis (patient fills primary anamnesis before visiting the doctor).

Paid services were listed as following: Live consultation with the doctor in charge; Quick answer or written questions; Data comparison with healthy person; Buying up in waiting list (implemented in the boundaries of obligatory regulations); Advertisement of supporting services/products (aimed for companies); Preferred offerings of supporting services (aimed for companies, e.g. lab services); Ordering of commented lab results.

2.2.2 Description of current e-PAK features

E-PAK portal is accessible through authentication with Estonian ID card or Mobile ID, which links users automatically with their personal identification code. Right now it is not a responsive website and is best accessible through PC. The portal is only available in Estonian language and has two different user interfaces, one for patients and one for healthcare workers:

1. **Patient's view**

In principle, there are two functionalities that a patient has in e-PAK: contacting his primary healthcare provider and managing self-health diary.

Options for contacting the GP practice include:

- Requesting an appointment
- Asking a question from the GP practice
- Notifications on changing or cancelling an appointment
- Ordering a repeat prescription
- Ordering a medical certificate
- Requesting and terminating certificate for sick leave

All options are semi-structured to better identify the reason of contacting the GP office and to already collect needed information about the specific request. When a patient is requesting an appointment or asking a question from GP, he is made to choose the symptoms causing the problem. The page then also displays typical solutions for the problem, recommendations for extra information on the topic and links to a web page where similar questions are answered by doctors. There's also a possibility for a less structured "other" field when requesting an appointment.

Patient's self-health diary consists of the following sections:

- Weight and other body measurements
- Blood pressure and heart rate
- Blood sugar
- Emotional State Questionnaire
- Medical history (self-anamnesis, family anamnesis, history of anamnesis)
- Health record (summary of inserted data and recommendations)

All data has to be filled in by a patient himself. The model of used device has to be specified when inserting blood pressure and blood sugar data. Patient can fill in an Emotional State Questionnaire, which calculates the risk for mental disorders and gives recommendations and contact information where to turn to when the test results indicate problems. Health record section makes a summary of the inserted measurements and provides information on which procedures and medical checks

are important in a certain age. A child patient's health diary includes possibility to record child's development progress: communication, movements and skills. In a child's health record section information about child's normal development and recommended medical procedures is given according to age. The initial idea of providing parents access to their children accounts is not yet realised, because receiving a permission from Ministry of the Interior to access civil registry has not been successful.

A separate side menu tab "health" summarises all information from health diary, including measurements and lifestyle data. Smoking, alcohol consumption status and allergies listed in self-anamnesis are displayed separately in this overview. A risk for cardiovascular disease is also calculated and displayed in the section. By clicking on the measurable data sections, all entries can be seen in graphs.

In addition, there is a side menu tab for priced services. Right now it directs to external web pages and other private providers who offer services of medical hotline, GP consultation from a private medical clinic, analysis for testing sexually transmitted diseases, and analysis for recreational athletes. The options also include three services, which are not available right now, but were meant to be offered by the GP practice using e-PAK: quick question to a GP; Commented laboratory results; Comparison of health data.

2. **Healthcare worker's view:**

The main features in the healthcare worker's view are mail box and patient search tool. The mail box enables to manage letters from all patients of the GP practice or only the ones from a personal practice list. Overview of incoming messages displays sender and addressee names, message type, heading and date. The heading is not a free text from a patient but indicates a reason of concern the patient has chosen previously. For example, a type of a message could be "question" and heading "abnormal blood pressure". All new messages, unanswered or "marked as active" messages are under the active tab. Responded messages with the correspondence move under the archive tab, letters can also be marked as archived. All incoming messages have a button to copy sender's personal identification code.

The search tool opens from the side menu tab “patient” and helps to find all health provider’s patients who are using the e-PAK by typing in at least three letters from their last or first name or by their personal ID code. Once the patient is found, one can access the correspondence with the patient, send a new message and check his health overview, which has the same content as the side menu tab “health” in patient’s view.

2.2.3 Use of e-PAK

E-PAK is currently implemented in four GP practices: Järveotsa, Kiili, Jürgenson and Ädala [41].

Järveotsa Family Health centre was the first to start piloting e-PAK from February 2016 as the portal was developed in collaboration with the head of the practice Diana Ingerainen. There are 7 GPs and 17 family nurses working in Järveotsa practice whose practice lists combined contain 12 825 patients.

Kiili GP practice is the smallest practice using e-PAK, it is made up of one GP and 4 nurses with a practice list of 1835 patients. They implemented e-PAK in May 2017. Jürgenson and Ädala GP practices both joined in June 2017. Both practices have 3 GPs and accordingly 4 and 6 nurses serving 5803 and 5834 patients [42, 43].

According to e-PAK statistics report from February 2018 the application is not yet too widely used. Järveotsa practice, where e-PAK has been implemented for the longest, has the highest usage with 14% from all patients. Three other practices have used e-PAK for less than a year and in comparison are the usage percentages also more than half lower (Table 1).

Table 1. Usage of e-PAK [17].

GP practice	**Patients in total (n)**	**e-PAK users (n)**	**Percentage (%)**
Järveotsa	12825	1778	14%
Jürgenson	5803	412	7%
Kiili	1835	107	6%
Ädala	5834	222	4%
All practises	26297	2519	10%

The distribution of e-PAK users by age groups is shown on Figure 1. The application is by far the most used by patients between 30-39 years of age (Figure 1).

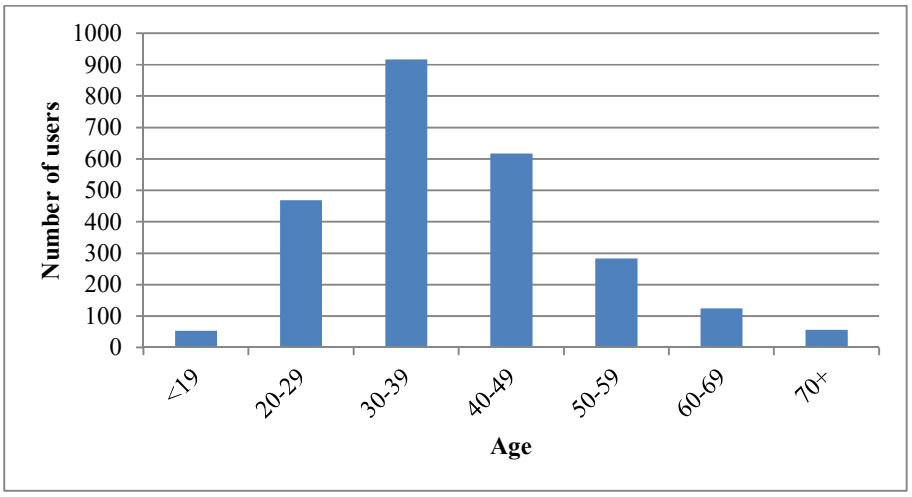

Figure 1. Age distribution of e-PAK users [17].

The most popular reason for contacting a GP practice through e-PAK has been requesting an appointment, which has been done over 4000 times. Ordering repeat prescriptions is the second most common way to use the application, whereas just asking questions from a GP is also fairly popular. Notifying about a wish to change or cancel an appointment is the least used option (Figure 2).

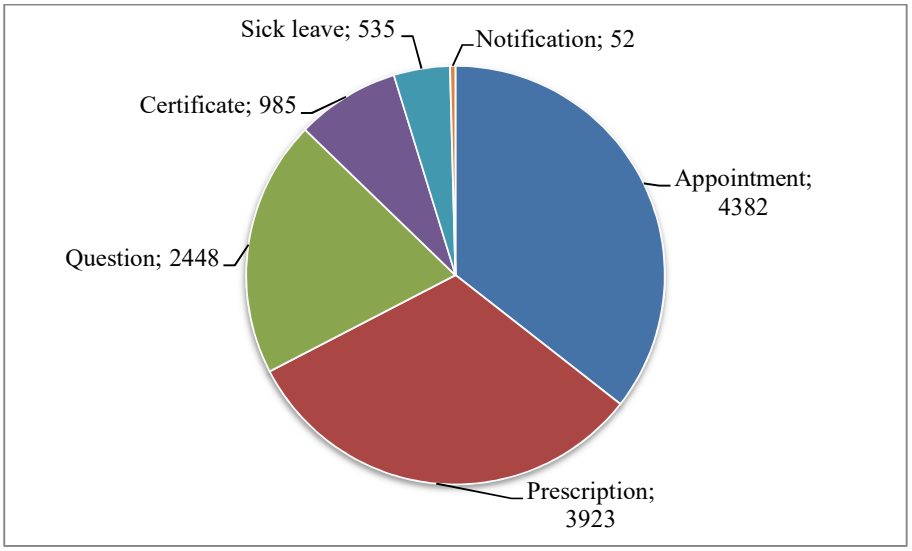

Figure 2. Frequency of reasons for contacting GP practice.

3 Research aim

The initial aim of the current thesis is to describe the perceptions and expectations of electronic communication with patients among the GP practices. Sub-goals of the research are as follow:

- Conduct interviews with healthcare worker users of e-PAK to get their opinion on the portal and electronic communication with patients.
- Conduct an electronic questionnaire among GPs and family nurses to see their perception on written electronic communication with patients and expectations for possible patient-physician portal for GP practices.
- Propose a solution for an electronic communication tool with patients according to the perceptions of GP practices' workers.

4 Materials and methods

4.1 Semi-structured interviews with e-PAK users

As almost no previous feedback was gathered from healthcare workers about their opinions on using e-PAK, it was decided to conduct qualitative interviews with key users to get better in-depth information on how the system is used right now, what are users' attitudes and thoughts on it. All practices using e-PAK, in total 4, were recruited to the study. The practices had introduced e-PAK between February 2016 and June 2017. Interviews were undertaken in March 2018 when practices had been using e-PAK for minimum of eight months and were still using the application.

Purposive sampling for interviewees was used. First, key persons for implementing e-PAK in every practice were contacted and through their recommendation another portal users were interviewed with their assurance that the shared opinions summed up the overall attitudes of e-PAK users in the practice, so that data saturation had been reached. All participants gave full informed consent. In total eight healthcare workers (three GPs and five family nurses) between ages 23- 51 were interviewed.

Interviews were conducted face to face or by phone (one case), lasted up to 50 minutes, used a topic guide (Ap. 1), and enabled insights on how e-PAK was currently used, what was considered as advantages or shortcomings about the application and how the future of e-PAK was seen. Interviews were audiorecorded, transcribed, anonymised, content coded and lastly divided into 5 themes.

4.2 Questionnaire on electronic communication between patients and GP practices

Two separate electronic questionnaires with identical content were created in Google Forms and sent respectively to mailing lists of Estonian Association of General Practitioners (n=785) and Estonian Association of Family Nurses (n=400) (Ap. 2).

Numerical data were analysed using simple statistical methods supported by Excel 2017.

The questionnaire consisted of 7 different sections, which were inquiring about the following:

1. GP practice's and personal e-mail correspondence with patients
2. Positive and negative aspects of e-mailing with patients (Likert scale)
3. Opinions on sensitive personal data requirements (checkboxes)
4. Knowledge of e-PAK
5. Obstacles for not using e-PAK
6. Evaluating the importance of given aspects in a patient portal meant for secure communication between patients and GP practice
7. The age of the respondent

Respondents who answered section 4 with *I am aware and use it/it is being used in my practice* were directed straight to section 6. Sections 2, 3, 5 and 6 closed with an opportunity to add opinion in free text.

The questionnaire was composed on knowledge from previously conducted interviews with e-PAK users. As all the interviewees had stressed the importance of electronic communication with patients, the first part of the questionnaire concentrated on e-mail communication with patients. The questions about the perception of e-mail communication with patients were composed using a survey from Neville *et al* 2004 and the answers from the interviews [44]. The question about obstacles for not using e-PAK were composed using Industry62 internal report about feedback from e-PAK introduction to GP practices [43]. Aspects about electronic portals for GP patients, listed for importance evaluation, were taken from the example of e-PAK, considering the reaction of interviewees. To be sure that the healthcare workers filling in the questionnaire would understand the questions, the way of wording was consulted with a GP.

5 Results

5.1 Results from semi-structured interviews with e-PAK users

Conducted interviews showed a variation in how practices had incorporated e-PAK into their workflow, but most commonly it was a tool for family nurses and only checked by GPs when a specific question could only be answered by them. There was a difference in how the use of e-PAK had been organised: 1) one nurse was mainly responsible for checking and responding to e-PAK and regular e-mail messages throughout the workday, when a certain question that needed GP's opinion, the response was typically still entered into the system by the nurse; 2) All nurses were responsible for using e-PAK alongside with all the other responsibilities like answering phone and doing procedures, GPs were told to check e-PAK only when a specific question needed their answer 3) Nurses and GPs both checked e-PAK as part of their everyday routine.

On every practice's homepage there was a link to e-PAK and information about e-PAK as a secure way of contacting the practice was included to automatic e-mail responses. e-PAK was very clearly only used for communicational purposes, no actions with patient's health diary were included to the workflow.

Five key themes emerged from the interviews: the importance of electronic communication with patients, advantages of using e-PAK, shortcomings of e-PAK, patient's health promotion and future expectations.

The importance of electronic communication

All interviewees agreed that electronic communication in general makes care delivery much easier and efficient. Even when the phone lines are occupied or it is not the office hours, patients can still forward their message, which will be read and answered. This was also said to lower the anxiety of patients.

Being able to answer a patient in writing was told to be less stressful for a healthcare worker as well, because the answer is not awaited immediately and there is more time to think and search or ask extra advice.

It was mentioned that dealing with patient's problems on a phone call is often much more time consuming as people tend to give a lot of unnecessary information alongside with needed answers. Also, the information from a phone call has to be written down and inserted into GP practice software anyway. Often a patient who has called is asked to send an e-mail (not e-PAK message) to describe the problem and forward information in writing. Using phone only to quickly specify something about the electronic message, e.g. available time for appointment, was much more preferred.

Everybody agreed, that electronic messaging helps to manage the workflow of the GP practice better and this way many problems find a solution without a patient needing to come for an appointment.

Advantages of using e-PAK

Being able to provide secure channel of communication was undoubtedly the strongest motivation for using e-PAK. Almost all interviewees expressed concern about meeting the requirements of handling sensitive personal data. Many mentioned the European Union General Data Protection Regulation coming into force soon as something that makes the security concern even more current. It was said that writing an answer through e-PAK is less stressful as one doesn't have to consider in every sentence, whether it could go against some requirements for sensitive personal data.

Secure messaging was also thought to be beneficial for some patients who are more anxious about their health data and one respondent said to have noticed than men use e-PAK more to tell about health problems which could feel embarrassing.

Other advantages of e-PAK were by far not described as important as the security aspect and some even found that with an exception of secure messaging, there is not much difference between regular e-mail and e-PAK. Nevertheless, more positive aspects were found.

Being certain about the identity of a patient is not only important for following regulations, but also for saving time, as it happens that in regular e-mails people forget to add their personal identification code or sometimes even full name. With one exception, everybody using e-PAK daily mentioned the convenience of being able to copy patient's personal identification code with one click, which made further procedures in GP software much quicker.

The inbox of e-PAK was generally evaluated more efficient than the one for regular mail, because it was easier to identify the content of messages and addressees. It was said that messages do not "get lost" among all the other information and stay active until someone has dealt with them. Being able to understand the type of messages at glance helped with prioritising answering, e.g. when somebody wanted to cancel appointment, this message could be dealt with quicker, vacant time was offered to a new patient and this way time and work was managed more efficiently.

It was found rather positive that the system "forces" patient to provide structured information about the reason for contacting the practice, so it is more likely to get needed information already with the first letter through e-PAK than e-mail. Having enough information helps to identify, whether a patient needs to see a GP, a nurse or the problem could be solved electronically, to prevent avoidable visits.

Very appreciated was an automatic response from the system to the patient that their repeat prescription was dealt with. Many praised the option to request a medical certificate, because it ensured that patients were already aware of needed procedures and the whole case was handled with an ease.

Shortcomings of e-PAK for healthcare workers

Although in general e-PAK was rated as rather an important and perspective tool, several shortcomings were mentioned as well as an opinion that it is not yet a complete product. Most of the healthcare workers found e-PAK already to be fitting their workflow without a problem. However, in one practice it was seen rather as an annoying obligation from nurses' perspective and would only have been seen beneficial if it was the only electronic channel for patients to contact. Also, unlike regular e-mail, e-PAK sends no desktop notifications, so checking for new messages there alongside all the other obligations, was found extra onerous.

As e-PAK is already a specially developed secure environment for a communication between patient and healthcare workers, almost everybody awaited more from it than from a regular e-mail. Interoperability with GP's software (commonly software called Perearst 2) was mentioned as a very important aspect to make using e-PAK more natural. Until it remains a separate application, the only real benefit is the security aspect, but much better user experience was expected. Everybody found it to be much

more beneficial when certain patient-provided information and requests, that right now need extra copy-paste actions, went straight to GP's software. A few fantasised, that theoretically one application should fit for everything and GP's software could also have the function of secure messaging with patients.

Some advantages of the application were at the same time found as disadvantages. For example, structured patient self-anamnesis were said to be often poorly understood and confusing, causing a need to call the patient back for specifications. Although "forcing" patients to give some structured information was generally found useful, most argued that it is easier to understand the concern from a free text written by a person. The system of reporting illness for sick leave and terminating the sick leave was also considered as essentially a good option, but currently sometimes confusing and again causing the need to call or write the patient for further specifications.

Everybody agreed that it is a definite disadvantage that right now parents are not provided with an access to their children profiles and this needs to be dealt with.

A couple of interviewees expressed greater dissatisfaction with the design of e-PAK. The current colour scheme made it difficult to notice some things and the layout was said to be at times not logical and uncomfortable.

Patient's view and health promotion

Almost none of the interviewed healthcare workers were too familiar with the patient's view of e-PAK, but the ones who were, said the health diary part to have very low user-friendliness.

Everybody agreed that patient's health diary could potentially be a very useful tool. It was mainly seen as an option for patient empowerment, not something directly useful in GP practice's work. Many mentioned that more lifestyle decision support tests and calculators could be motivating and have a benefit for patient's health behaviour. Already existing Emotional State Questionnaire was said to be a positive example. Alerts for patients according to their health data figures were suggested as another possible way to engage them more with guiding their own health.

Very short and comprehensive overview of patient's health data was still thought to be beneficial for healthcare workers in some situations. Blood pressure diary was also seen

to have potential as many patients are anyway asked to keep one. Here a simple way to transport this data to GP software was mentioned again.

Although there was still thought to be many patients who are not tech-savvy enough to use e-PAK, it was generally agreed an electronic environment to contact GP practice is already important and will be so even more in the future.

Future expectations

Some of the interviewed healthcare workers were mainly happy with an option to have a secure way for messaging. Although they did come up with some aspects that could be better and fantasised about future possibilities, they did not have too strong expectations for how e-PAK has to be improved. The others, however, stated loudly, that e-PAK's development has to be in close cooperation with healthcare workers in order to make it a really useful and convenient tool. An application like e-PAK was seen as something that will never be a fully complete product, but needs continuous progress and therefore developers who are highly motivated to be engaged in it.

In addition to already mentioned shortcomings of e-PAK and potential health promotional developments, there were some extra proposals for improvements. Most of the respondents thought that digital registration for patients should be available at least to some extent. One idea was to only give appointments for medical certificate free to choose from and register to. There was also an opinion that almost all appointment times could be left for patients to choose from and only a small amount needs to be left for emergencies. It was suggested that there could be more automatic responses like the one about repeat prescription being prescribed. For example, an automatic "thank you for letting us know" letter when patients are cancelling appointments or reminder with instructions before a medical certification appointment. Also, a possibility to automatically add a polite message signature was mentioned.

In e-PAK project plan mobile application was mentioned as one of the key features. In interviews making e-PAK mobile was mainly seen as very important for patients' side, as cell phone was thought to be the most convenient mean of access for a lot of patients. It was especially stressed in the context of health diary. A few still thought that also healthcare workers could benefit of easily accessing e-PAK elsewhere than in office

computer. This way modern approach of work out of office could at times be made possible.

Priced services for patients, which were planned to be the profitable part of e-PAK, are not yet a reality and the respondents' opinion on this was divided, but rather negative. The current system, where almost all GP practice's work is reimbursed by Estonian Health Insurance Fund wouldn't leave room for any extra paid services from work hours, but nobody was eager to provide anything from their free time. As it is anyway part of the current job to help patients with inevitable health problems, everybody was afraid that people using paid services would not have too serious troubles and dealing with them would be a waste of time. It was even thought to be boosting health anxiety, which is something that GPs should be fighting against. Since primary health care has to be equally available, priced services were thought to create an unequal impression for the patients. The respondents who weren't so fiercely against paid services for patients could not think of any that could be provided through an electronic portal.

5.2 Results from the electronic questionnaire on use of electronic communication with a patient in a GP practice

All results from the questionnaire are visible in Appendix 3. The questionnaire was completed by 150 respondents from who 80% were GPs. Most participants were between 30-60 years old and almost everybody indicted that patients can contact their practice via e-mail. The 5% who stated otherwise, still reported having sometimes or rarely been in an e-mail correspondence with patients. Almost half of all the respondents were e-mailing with their patients all or most working days (Figure 3).

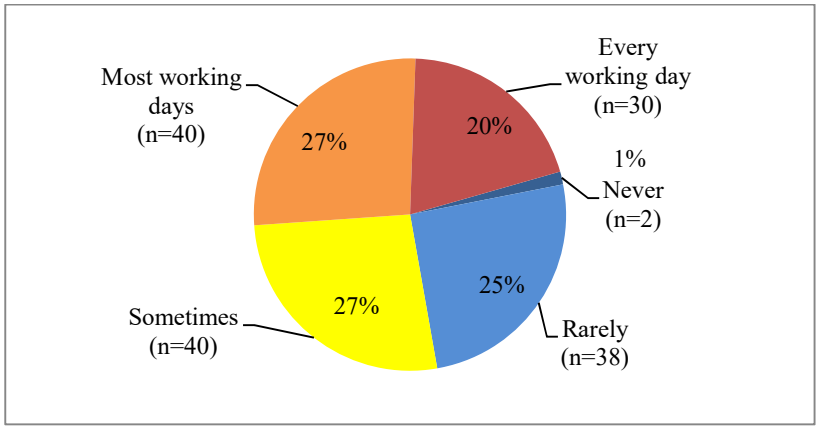

Figure 3. Frequency of e-mail correspondence with patients

5.2.1 Assessing positive statements on e-mail correspondence with patients

Although around quarter (27%, n=40) of respondents disagreed or disagreed strongly with the statement that most of their patients have access to e-mail, there were still more who agreed strongly or agreed (45%, n=68) with that.

Almost half of the respondents (n=69) disagreed or disagreed strongly on e-mail being a secure way of communication, but a relatively high number of participants (n=48) could not exactly agree or disagree with the statement, whereas the percentage of neutral opinions was higher among nurses (Figure 5).

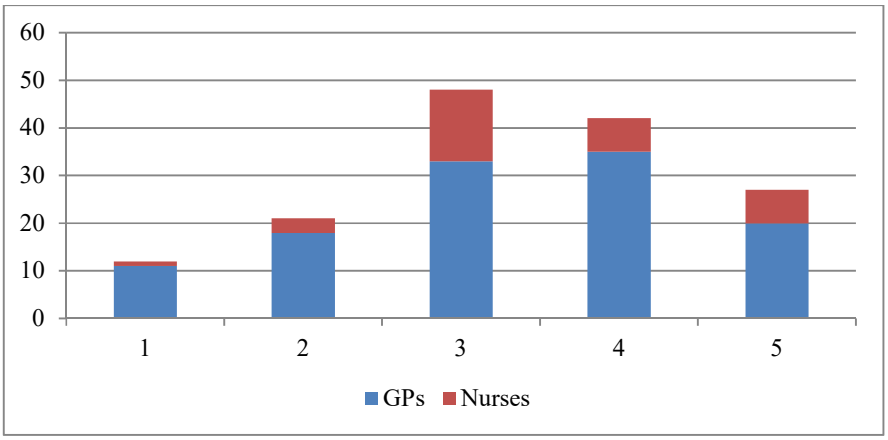

Figure 4.Assesment of e-mail communication being safe

No value specifically stood out from the statement that e-mailing is a convenient way of communication, but it was the least popular (n=19) to disagree strongly with it. The preference of e-mail communication with patients being convenient was more strongly noticeable only among every day users (Figure 6). There was a comment left in a free text field by one strongly disagreeing respondent, stressing that e-mail communication is convenient for a patient, but not for a healthcare worker. A neutral respondent also stressed e-mail being convenient for patients. One agreeing participant assured e-mail consultation being a convenient method and said it to be especially used for giving nutritional advice. Another said that e-mail can be very convenient for some instances, like for repeat prescription and terminating certificate of sick leave, but can become an onerous *ping-pong correspondence* with some patients with health anxiety.

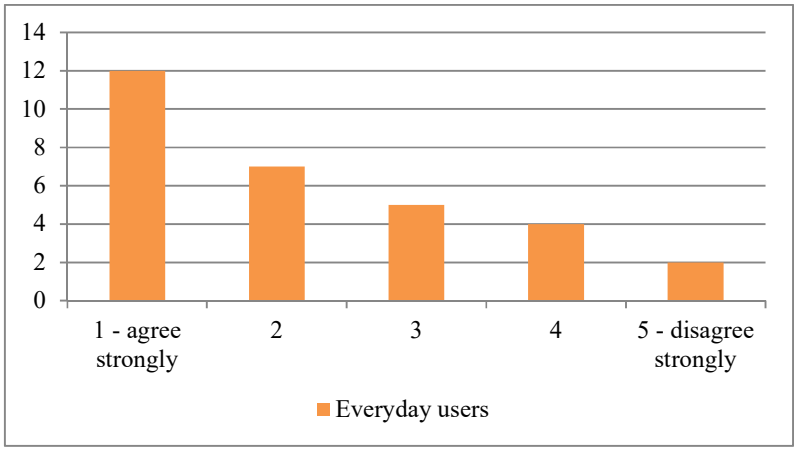

Figure 5. Assessment of e-mail being a convenient way of communication

It was mostly agreed strongly and agreed with that the use of e-mail can widen the options for contacting the GP practice (66%, n=99), but there was not too much consensus from the respondents about most of the other positive statements. Two respondents who agreed with e-mail helping to organise work better, commented that some problems can be easily dealt with via e-mail and this way there is more time left for the patients who need face-to-face consultations. Four participants who disagreed strongly or disagreed with the statement, brought out how e-mail correspondence is much more time consuming and often needs to be dealt with after working hours. Moreover, patients tend to *become dependent on this easy way of communication and burden GP with every possible question*, assuming that healthcare workers should be responding *24/7*.

There were no explicit opinions on whether e-mail is a faster way for identifying patients and whether it is less stressful to answer patient's questions via e-mail compared with phone, but for both questions the number of respondents who disagreed strongly was the highest (respectively n=45 and n=47). Notably, the most popular answer among nurses, almost 40%, was agreeing with the statement that e-mail enables to faster identify patients (n=13).

5.2.2 Assessing concerning statements on e-mail correspondence with patients

There were more similar answers to concerning aspects about e-mail correspondence with patients. Majority (75%, n=113) expressed concern about the security of e-mail by agreeing strongly (n=78) or agreeing (n=35) on an existing security risk in e-mail correspondence with patients (Figure 7).

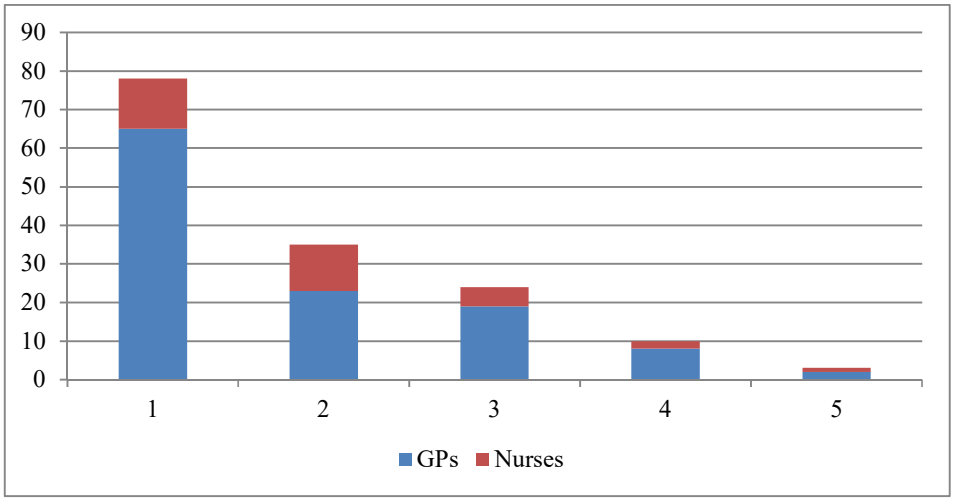

Figure 6. Assessment of security risk on e-mail communication with patients

Preferring to see the patient was the only statement in this section that was not so clearly more agreed with, as the most popular answer among the respondents was to stay neutral (35%, n=52). Still, it was much more common to agree with the claim (50%) than disagree (15%). The difficulties of making a diagnosis by e-mail were expressed more strongly than the preference for face-to-face contact with patient. Although, it was still the minority (n=22) who disagreed or disagreed strongly with preferring to see the patient. E-mailing using up the time to see patients was also rather agreed with.

Most of the respondents agreed that it is difficult to make diagnosis via e-mail and expressed concern for not having enough time to answer all the e-mails. E-mail correspondence with patients being an extra burden in already onerous job was also expressed by the majority (70%, n=105) (Figure 8).

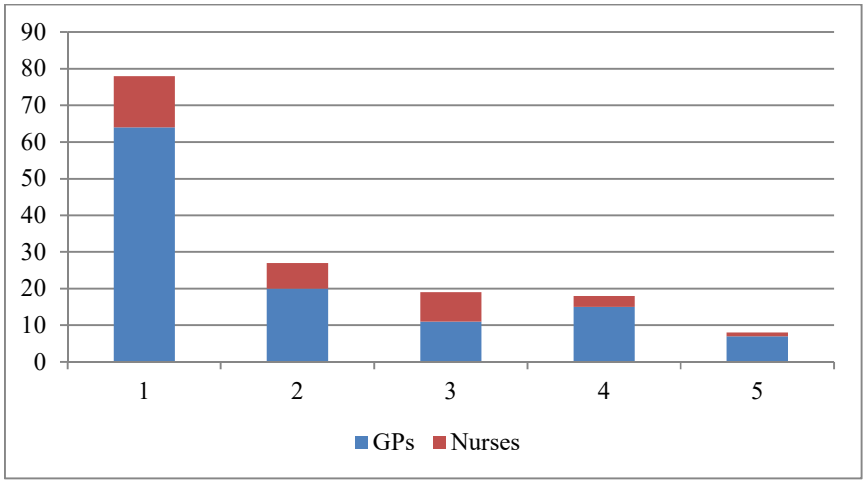

Figure 7. Assessment of e-mail being an additional burden in already onerous job

5.2.3 How requirements for sensitive personal data affect healthcare workers

Almost 70% of respondents (n=104) indicated that the requirements for sensitive personal data make them carefully consider the choice of words when composing e-mails. Meeting the requirements was considered to be a challenge in organising the everyday work by almost half of the respondents (n=71). Around one third indicated, that requirements for sensitive personal data are not too clear for them (n= 55), have become more current in the light of the European Union General Data Protection Regulation (GDPR) entering into force on the 25th of May 2018 (n=53) and force searching alternatives to e-mail (n=48). Less than one fifth thought that the requirements were already well met (n=26) and did not think this had too important impact on their everyday work (n=22) (Figure 9). Two comments in the free text explained, how e-mail is only used for organisational matters in their practice and no sensitive data is sent via e-mail. One respondent wrote that although the security risks are known, they still use e-mail. It was also implied that the requirements for sensitive personal data are the reason for trying to use less e-mail communication. One comment explained that when a patient asks them for some results via e-mail it is considered as their consent on sending this data via e-mail.

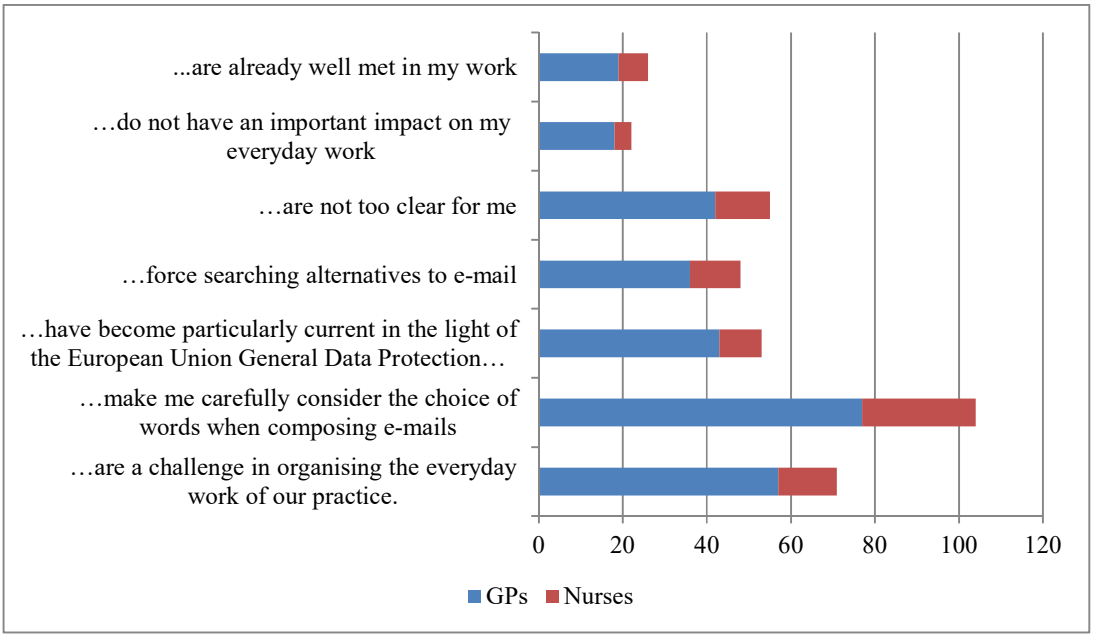

Figure 8. "Requirements for sensitive personal data…"

5.2.4 Knowledge on e-Perearstikeskus

More than half of the respondents had never heard of e-PAK (n=86), and the rest had mainly (n=50) not seen a reason to use it.

Having not heard about this option was also the main obstacle for the majority (n=76) for not using e-PAK. Out of the 76 who had not heard about e-PAK 23 still added extra obstacles besides not knowing about it: the worry that it would not fit workflow and create extra work and the doubt that it would not bring any extra value were the main reasons chosen. These reasons were in general marked as third and second most common obstacles. 37 respondents also thought that their patients would not use this kind of solution. Lacking employees with suitable skills was not seen as a major problem (Figure 11).

3 out of 10 comments left in the free text option expressed the possibility of taking e-PAK into use in the future. One said that some of the practice' workers are against it because they lack skills. It was also mentioned that patients can anyway contact them by coming to the practice, calling or via e-mail and Facebook – there is no need for an extra channel. 4 comments stressed how this would only create extra work. There was also an opinion how e-PAK is too patient-centred and gives a needles access, at the same time not being suitable for patients out of the practice list.

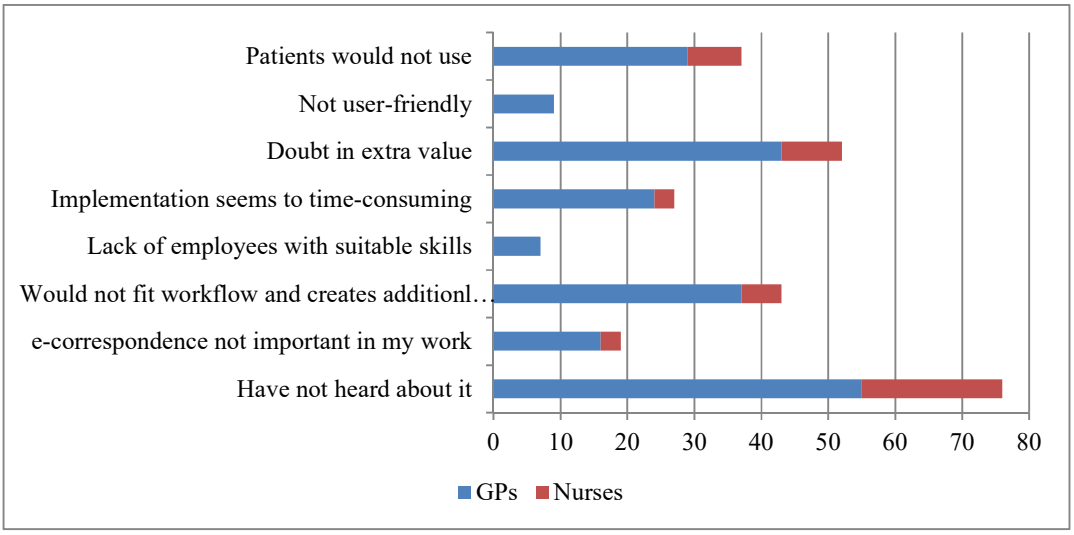

Figure 9. Obstacles for not using e-Perearstikeskus

5.2.5 Important aspects about a secure portal for GP patients

When the respondents were asked to evaluate different aspect about a secure portal meant for electronic communication between patients and GP practices, four factors stood out as being clearly very important. Interoperability with GP software (such as Perearst2) and the solution being free for GPs were both marked as very important by 98 respondents and nobody considered them absolutely unimportant. Other aspects stressed as very important were including healthcare workers feedback to portal's development, and that the system would request patient to insert reason of contact and relevant symptoms.

Almost 80% (n=118) thought that it would be rather or very important that healthcare workers had an automatic option for more common responses, like informing about issued repeat prescription or thank-you-for-informing note. Over 60% marked as rather or very important also the following aspects: parents having access to children's profile, portal being mobile, having an overview of patient's health diary, which is filled in by himself.

Digital registration and an option to earn bonus through the portal were, compared to other aspects, rated as the most unimportant. Nevertheless, over half of the respondents (n=85) still thought that an option for digital registration would be rather or very important. And almost half (n=72) found an option to earn bonus rather or very important (Table 3).

By every aspect there were 12-20% respondents who indicated that they could not asses this feature right now. Using healthcare workers' feedback for portal development and having automatic responses were two aspects with the lowest rate of participants who could not decide on the importance.

Four extra opinions out of 13 left into free text comment field, stressed that digital registration would only bring extra work, because patients themselves cannot assess the need and type for an appointment so accurately as healthcare workers who are registering the appointments right now. Three respondents reassured that they have not used the portal and would want more information. One added that if the portal integrated with the newest version of GP's software and with the national patient portal, it would be a useful tool. Another found a new portal useless, unless it was integrated

with other systems. Somebody who had previously marked being aware of e-PAK and wanting to use it, added that it is a truly convenient tool for a patient. One comment stressed how patients' feedback is also important in portal development. Another respondent found that this kind of portal would make patient's life even more convenient, but thought that instead of that something useful could be developed for GPs. One participant expressed concern that making portal mobile would mean that GPs had to be available around the clock.

6 Discussion

The fact that e-PAK was developed from the initiative of a GP who is also the head of a GP practice, shows that there is some visible need for similar services from the healthcare workers perspective. The user statistics for the use of portal from patients' side are not too high, similar to the national Patient Portal. As e-PAK has not been in use for a long time and many patients in the practice list have probably not even had a reason to contact their GP, it would have been more accurate to compare user activity against the number of those patients who have turned to their GP in the timeframe. Nevertheless, the interviews revealed, that contacting via e-mail was still more popular than using the portal. It is difficult to say it with an exact certainty, without carrying out a study among the patients, but one might suggest that low knowledge, poor user experience and low need for the service might play a role. When patients who prefer electronic communication can access practices also via regular e-mail, then their motivation to use a new portal with more time-consuming log-in might not be too high.

It was clear from the interviews with the e-PAK users that the healthcare workers used the portal only as a communication tool. It is not discussed in this work, how e-PAK corresponds to all the aspects of security, the main interest for GP practices is to have a partner, that promises to ensure secure channel and this way takes the responsibility from the practice. All interviewed healthcare workers were clearly concerned how to do their job without a risk of not following the requirements for handling sensitive personal data and really appreciated a chance to use an alternative secure channel for electronic communication. Security aspect was also important among the respondents of the survey, much like found in other studies [2, 6, 7]. The slight difference with responses to e-mail being a secure way of communication and e-mailing having a security risk might come from the fact that it is also possible to exchange e-mails that contain no sensitive data (e.g. dietary guidelines). The question about requirements for sensitive personal data also indicated that most of the healthcare workers are concerned about the topic and need more information or better solutions for being able to deal with this in their everyday work.

When the interviewed e-PAK users were very positive about the use of electronic communication in general, then the advantages that they brought up were not so straightforwardly positive among the respondents of the questionnaire. One aspect to note is that GP practices that are using e-PAK were already used to electronic communication in their everyday work, before even implementing e-PAK, but around half of the questionnaire respondents were not. Only the respondents, who were used to exchanging e-mails daily, agreed more on it being a convenient way of communication with patients. Still, regardless from how often e-mail was used for correspondence with patients, it was more likely considered time-consuming and seen as an extra burden. The reasons for not using e-PAK, besides not knowing about it, also indicated fear for additional work and time inefficiency, which does not bring enough value. Concern for electronic communication bringing extra work has also been described in the literature [2-6].

It was clear from the interviews with e-PAK users and also stated so by the respondents of the questionnaire that an additional portal made for communication with patients should also have interoperability with other software used in the work. GP practice workers already need to manually insert a lot of data to different systems and one more place, which has no help in making the work easier, has no good perspective. Other aspects facilitating work, like prior knowledge about the reason of contact and automatic responses were also considered important. Digital registration for GP practice appointments was something that the interviewees did not quite agree on, and the opinions on it were also more divided in the results from the questionnaire. Everybody would probably be favouring the system when it had an effect on decreasing workload, but many seem to doubt that and are probably afraid of the contrary. In short, if there already is an extra tool then it has to disburden the work and no new electronic solutions are seen favourable unless they serve this aim.

Quite naturally, almost all healthcare workers were interested that their feedback was used for this sort of portal's development and that the portal was free for charge for healthcare workers. The reason why e-PAK is not yet a very handy tool and still needs many improvements might lie in a deficient business model. Although e-health solutions should be profitable in any case, it is more crucial when a private company is in charge instead of the state. The state can be interested in supporting a tool that makes the work of the GP practice easier, but a private company needs to earn a profit to be

motivated in continuous development and improvement of the software. Industry62's initial thought for adding paid services for patients has not been realised and was also not considered positive among the interviewees. Interestingly, around half of the questionnaire respondents found an option to earn bonus important. But they also only had to evaluate this one statement, without any extra explanations on how this bonus could be earned. Still, a research among patients, whether they would even be willing to pay for any extra services, could bring some perspective.

It was clear from the interviews that e-PAK is currently only used as a communication tool, although a potential was seen in patients' health diary option. Empowering patients to make more decisions about their lifestyle was seen as a good thing and possibly attainable through the patient portal. For patients to be motivated to use such features, they have to be made as easy and convenient as possible. Also, an option to monitor patients (e.g. chronically ill) through the common portal was thought to be beneficial. However, this was not seen as the first priority and most of the interviewees were not even familiar with the patient view on the portal and how their profiles with health diary looked like. Overview of a patient's health diary was seen as important by more than half of the questionnaire respondents, indicating that when this feature was presented in convenient way, it could be helpful.

The questionnaire sample of 117 GPs and 33 family nurses who only had a chance to fill in the questionnaire electronically might not be extensive enough to make any final conclusions about the perception of all the GPs and nurses working in Estonia. However, it definitely shows some trends and brings out the aspects about electronic communication with patients in primary care that should be considered when trying to improve anything in the field.

7 Conclusions

All GP practices in Estonia have computers, internet connection, are already using some sort of medical software and are obligated to forward medical data to national EHR. The current thesis does not present exact numbers on how many practices are using electronic communication with their patients, but it is clear that for patients this is one way of contact besides face-to-face and phone interactions.

Growing workload and data security come through as the main concerns about e-mail communication both in literature overview and in the practical part of the current work. Even if an idea of a secure communication portal is presented, the fear for growing workload stays. Therefore, despite data security being a very important aspect, this alone might not be motivating enough for healthcare workers to adopt new software. They need to feel that electronic communication is not only making patient's life more convenient, but theirs as well.

A secure patient portal for GP practices needs to bring extra value to the work. Electronic messages from patients need to contain enough structured information to quickly identify them and their problems, and also responses from healthcare workers should be automatized when possible. Any data that has to be inserted into other software should be easily or automatically transferrable. This includes data entered by patients themselves. The current thesis did not investigate patient motivation for the use of electronic communication, but the author suggests that for high adoption rate, the portal needs to feel as a necessity also for patients. It should be the only possible channel for electronic communication with the practice. Aside for good user experience with health diary and potential lifestyle decision support test, patients need to see that also their healthcare providers can use the information. Therefore, a quick but informative overview for medical workers should be composed from the health diary.

E-PAK, already existing patient portal for GPs and their patients, has a good potential to meet most of the expectations listed if it enabled data transferral to other software. Other features can be further developed and enhanced to meet the vision of healthcare workers and patients. One considerable obstacle for that, like for many e-health

solutions developed with one-off grants, is the lack of business potential in Estonian market, where healthcare is a public good. It is not realistic that a private company would be interested in constantly maintaining and developing something that does not earn profit. When this kind of portal is only seen as free of charge for both GP practices and patients, the financial support needs to come from the state. The other option could be to provide priced services for patients that allow medical workers to earn extra income. Which services would be attractive for both patients to consume and healthcare workers to provide, needs further research.

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Appendix 1 – Semi-structured interview questions for e-PAK users

1. **Perception of e-PAK**

Overall emotion: has using e-PAK felt helpful or rather onerous?

What is the main motivation for using e-PAK?

Do you feel that e-PAK contributes to care delivery?

2. **The usage of e-PAK right now**

How often do you use the application in your everyday work?

Does e-PAK fit well into your normal workflow?

3. **Content of e-PAK**

How do you feel about the functions of e-PAK is there anything missing or excessive?

How well are you aware of the patient's view on e-PAK? Do you recommend any functionalities of e-PAK to your patients?

Patient's self-monitoring and health diary – has there been any use of it for a healthcare worker?

4. **Promotion**

How do your patients know about e-PAK

5. **Development of e-PAK**

How do you see the development of e-PAK, what needs to be done and how?

Do you think mobility would be an important feature of the application, should it be a responsive website, easy to use in all devices?

Would you be prepared to offer paid services to a patient through e- PAK?

Could e-PAK benefit from more decision support systems directed to patients?

Appendix 2 – Questionnaire on use of electronic communication with a patient in a GP practice

1. **Can a patient access your medical practice via e-mail?***
   - Yes
   - No
2. **How often do you exchange e-mails with patients?***
   - Never
   - Rarely
   - Sometimes
   - Most working days
   - Every working day
3. **E-mail correspondence with patients. How do you agree with following statements?*** *(Questions had to be evaluated from 1 to 5, 1=agree strongly, 5=disagree strongly)*
   - E-mail is a secure way of communication
   - It is a convenient method of communication
   - It widens the options on contacting our medical practice
   - It helps to better organise the work of our practise
   - Identifying the patient is faster than in a phone call
   - Answering patients' questions is less stressful than in a phone call
   - Opportunity to contact by e-mail reduces patients' anxiety
   - Most of my patients have an access to e-mail
4. **Concerns about e-mail correspondence with patients. How do you agree with following statements?*** *(Questions had to be evaluated from 1 to 5, 1=agree strongly, 5=disagree strongly)*
   - There is a security risk
   - I prefer to see patients
   - It is difficult to make a diagnosis using e-mail
   - There is not enough time to respond all the e-mails
   - E-mailing will use up time for seeing patients
   - E-mail is an additional burden in already onerous job
5. **Do you wish to add anything?**
6. **Requirements for sensitive personal data… (Select all that apply)***
   - …are a challenge in organising the everyday work of our practice.
   - …make me carefully consider the choice of words when composing e-mails
   - …have become particularly current in the light of the European Union General Data Protection Regulation (GDPR) entering into force on the 25th of May 2018
   - …force searching alternatives to e-mail

- …are not too clear for me
- …do not have an important impact on my everyday work
- …are already well met in my work

7. **Do you wish to add anything?**
8. **Are you aware of a portal e-Perearstikeskus, which enables secure communication between the patient and the GP practice (identifying via ID-card/mobile-ID)? www.eperearstikeskus.ee***
   - I am aware and use it/it is being used in my practice
   - I am aware of it and would want to use it/ would want it to be used in my practice
   - I am aware of it, but have not seen a reason for using it
   - I do not know what it is
9. **What are the main obstacles for implementing e-Perearstikeskus in your practice? (Select all that apply)*** *This question only appeared to respondents who didn't pick the first option in question number 8.*
   - I have not heard about this option
   - Electronic written correspondence with patients is not important in my work
   - This kind of solution would not fit the workflow of our practice and would create additional work
   - There's a lack of employees in our practice who would have suitable skills for this
   - The implementation of e-Perearstikeskus seems too time consuming
   - I doubt that the use of e-Perearstikeskus would add enough extra value
   - It does not seem user-friendly enough
   - I think my patients would not use it
10. **Any other option?**
11. **e-Perearstikeskus, which provides secure communication between patients and a GP practice, is currently used in four practices. Based on the interviews conducted with portal users, we would like to know how important would you consider the following aspects about similar solutions:**
    Every aspect had to be assessed with one of the following: very important; rather important; rather unimportant, absolutely not important; I cannot assess its importance right now
    - The system requests patient to insert the reason of contact and relevant symptoms
    - Interoperability with GP software (e.g. Perearst 2)
    - Healthcare worker has an automatic option for more common responses (repeat prescription issued, thank you for informing about the appointment cancellation)
    - Parents have an access to children's profile
    - Digital registration option
    - The solution is free of charge for GP practice
    - Mobility (accessible from cell phone, tablet – out of office)
    - The portal is developed according to the feedback from healthcare workers

- An option to earn bonus (priced services for patients: eg. quick question to GP office, commented lab results)
- Overview of patient's health diary, where he can add blood pressure and blood sugar measurements etc.

12. Would wish to add anything?

13. Your age:*

- Under 30
- 30-40
- 41-50
- 51-60
- 61-70
- 71+

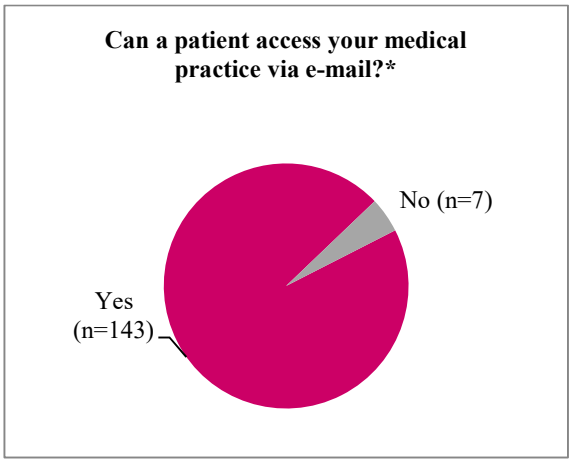
All questions marked with an asterisk (*) were required and could not have been skipped

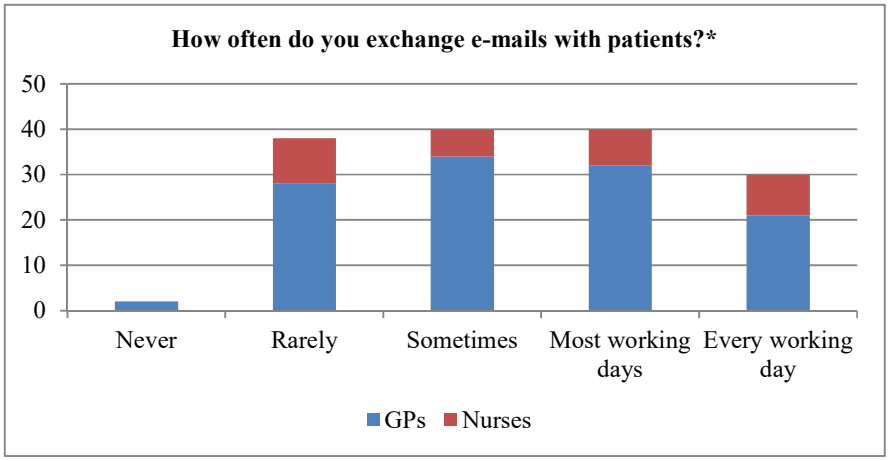
Appendix 3 – Results from electronic questionnaire

Respondents' profile:

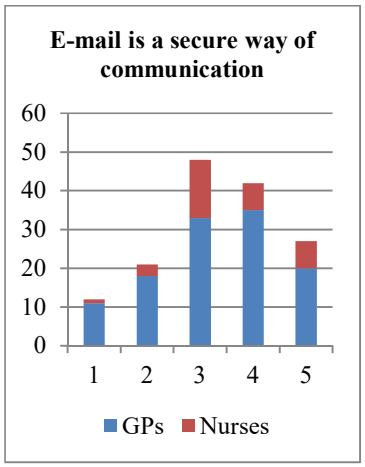
Age	GP (n)	Nurse (n)	Total (n)
Under 30	7	3	10
30-40	18	13	31
40-50	36	7	43
50-60	41	10	51
60-70	15	0	15
All ages	**117**	**33**	**150**

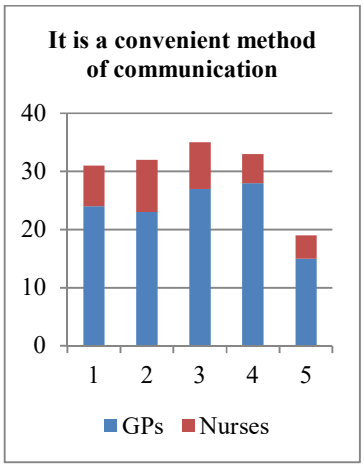
E-mail correspondence with patients. Access and regularity:

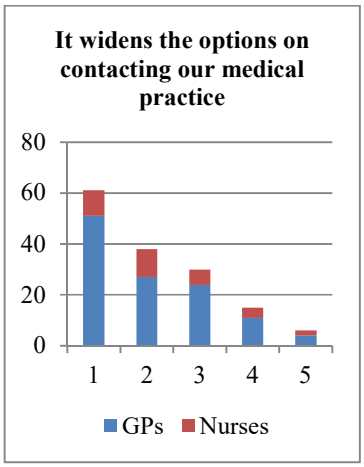


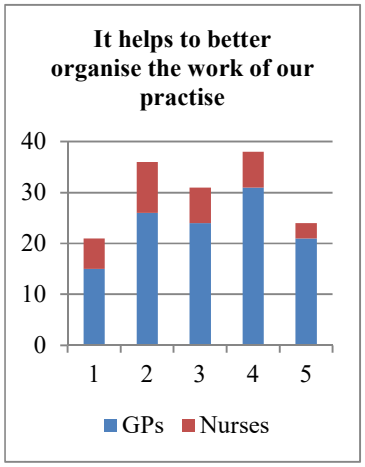


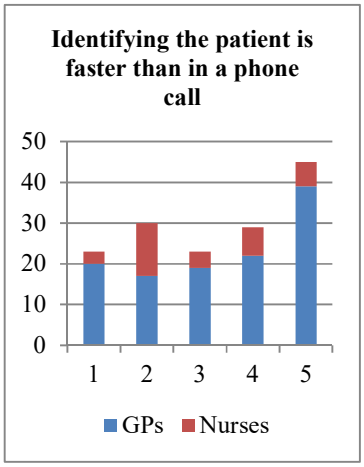
E-mail correspondence with patients. How do you agree with following statements?
(1=agree strongly, 5=disagree strongly)

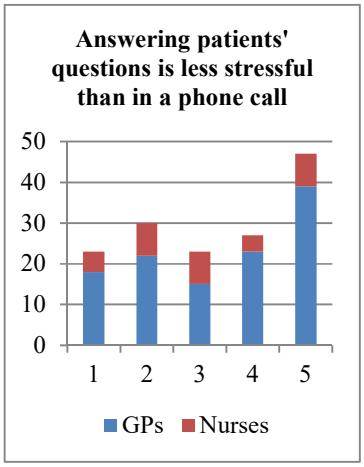


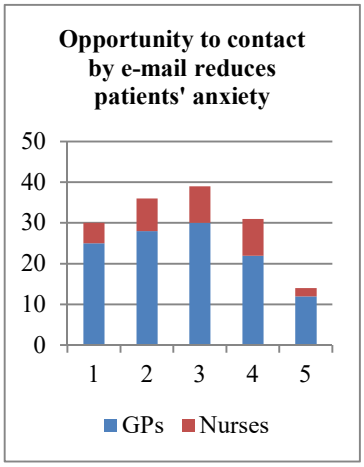


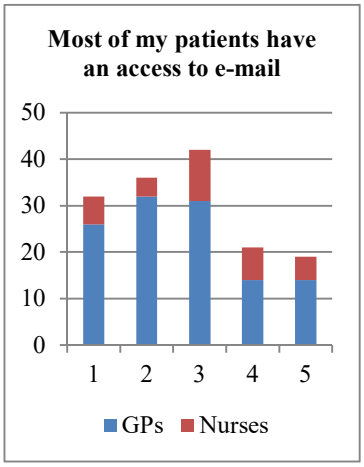




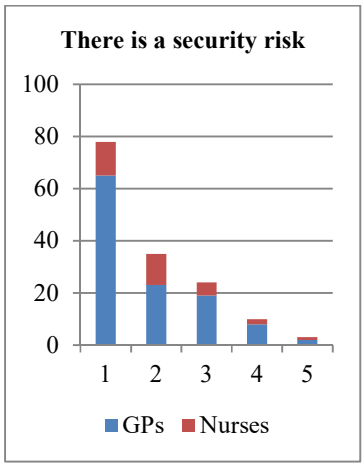


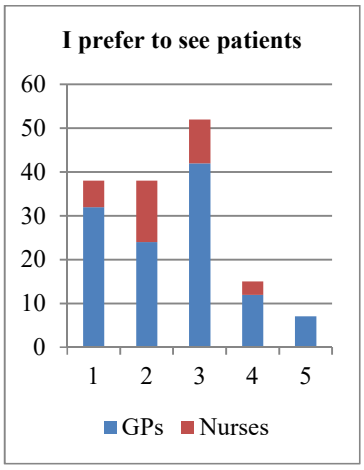


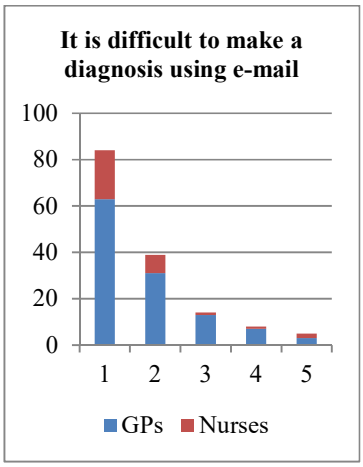


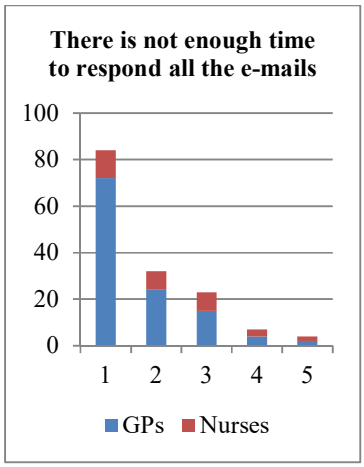


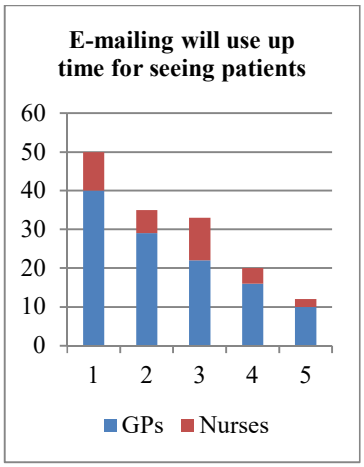
Concerns about e-mail correspondence with patients. How do you agree with following statements? (1=agree strongly, 5=disagree strongly)

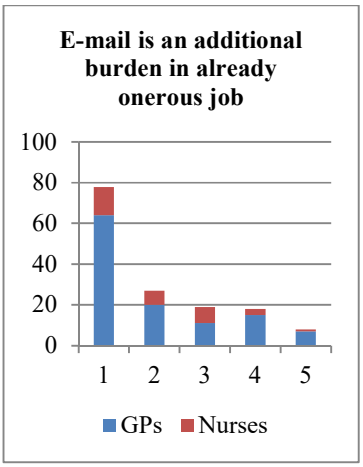




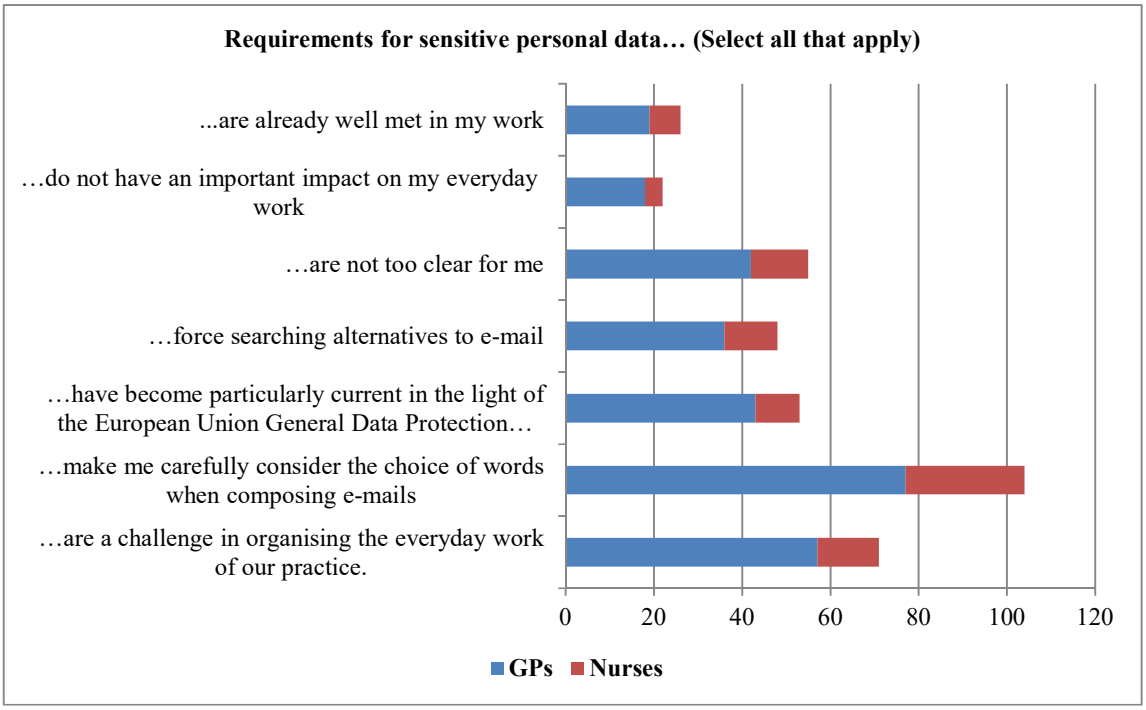




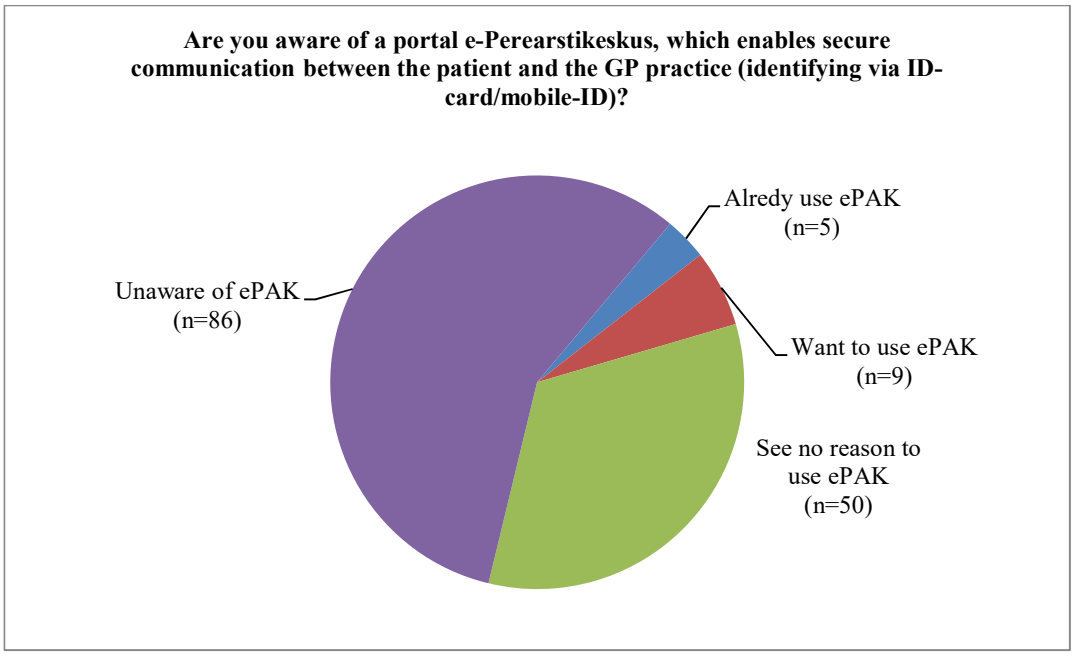




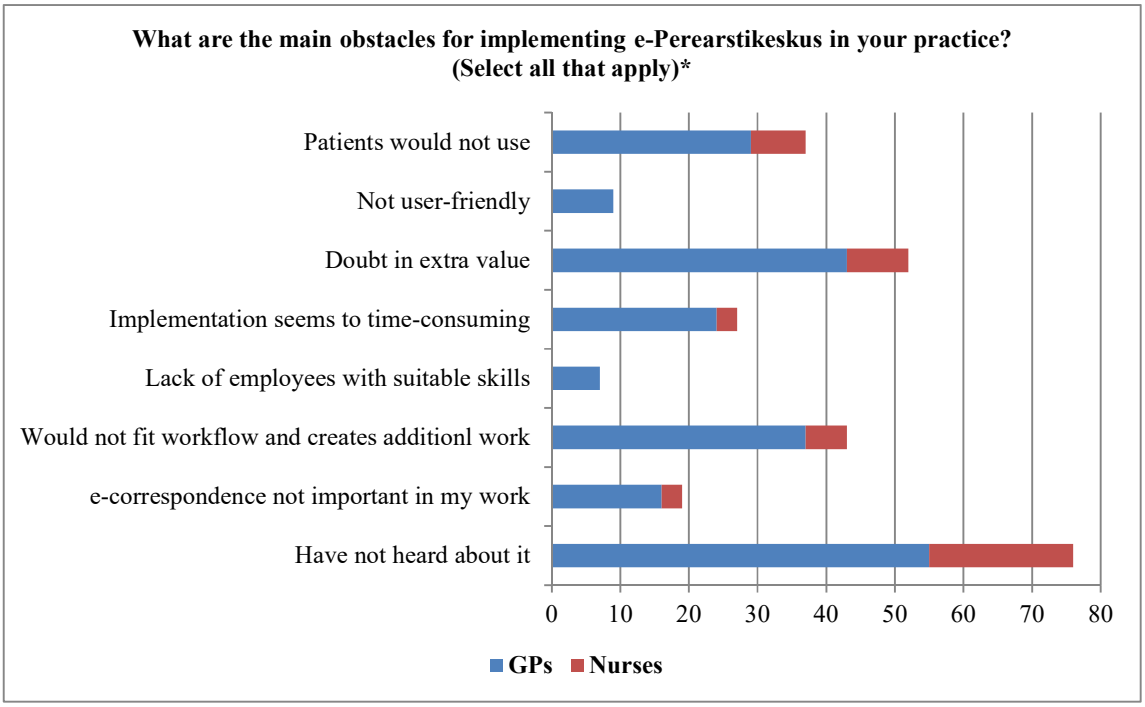
Opinion on requirements for sensitive personal data:



Knowledge of e-PAK:



Obstacles for not using e-PAK:



e-Perearstikeskus, which provides secure communication between patients and a GP practice is currently used in four practices. Based on the interviews conducted with portal users, we would like to know how important would you consider the following aspects about similar solutions:

	Very important (n)	Rather important (n)	Rather unimportant (n)	Absolutely unimportant (n)	Cannot assess at the moment (n)
Interoperability with GP software	98	25	2	0	25
The solution is free of charge for GP practice	98	24	6	0	22
System asks for the reason of contact and relevant symptoms	94	31	2	0	23
Healthcare workers' feedback used for portal development	94	34	3	1	18
An automatic option for more common responses	70	48	10	2	20
Parents have access to children profiles	55	46	17	4	28
Overview of patient's health diary	53	48	18	4	27
Mobility (accessible from cell phone, tablet – out of office)	51	48	15	9	27
Digital registration option	41	44	18	18	29
An option to earn bonus	30	42	31	16	31