INTEGRATION OF PERSONAL HEALTH RECORDS IN THE INFORMATION PROCESSES OF GENERAL PRACTICES

Marije van der Geest 2600889

VU University, Amsterdam
Management, Policy-Analysis and Entrepreneurship in Health & Life Sciences (MPA)

Nictiz

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Marije van der Geest
Student number: 2600889
Telephone number: 06-20709606
Email address: marijevdgeest@gmail.com
Master program: Management, policy-analysis & entrepreneurship in the Health and Life Sciences (MPA)
Specialization: Health & Life Sciences-based Policy

Internship placement
Nictiz
Address: Oude Middenweg 55
2491 AC Den Haag
Telephone number: 070-3173450
Email address: info@nictiz.nl

Supervisors

	Vincent van Pelt	Myrah Wouters	Eduardo Urias
Telephone number:	06-43775480	06-41082400	020-5987512
Email address:	pelt@nictiz.nl	wouters@nictiz.nl	ems216@vu.nl

Summary

Over the past years there has been a trend towards more patient-centered healthcare, to make the patient the manager of his or her own health. This self-management is thought to give the patient more insights in their medical situation. It is thought that patients would feel more responsible for their own health, resulting in better health.

One initiative to accomplish this self-management is the use of Personal Health Records (PHRs). A PHR should be an application for people to view and manage their own health data. Currently every professional keeps their own files. Sometimes there is an online portal available where the patient can access their information, but this is often limited to only one healthcare provider or target group.

PHRs aim to change this. Providing one place where they can see their information from multiple disciplines, including hospital, laboratories and the General Practitioner (GP). A PHR can also facilitate contact with healthcare providers. Furthermore, patients can add their own data, for example self-measurements. The patient is in charge; he or she decides what data will be shared and with whom.

To make the PHR a successful solution, medical professionals should also actively use PHRs. However, it is still unclear how medical professionals, such as GPs, can use it. Therefore, the aim of this research is to identify the prerequisites that allow GPs to use and integrate PHRs in their information and working processes. This will be done by making an inventory of the aspects that are affected when integrating PHRs in the information processes of general practices. Leading to the following research question: *How can PHRs be integrated in the work and information processes of general practices, to make PHRs usable and an added value for GPs?*

This research used the Technology Acceptance Model (TAM) (Davis, 1986; Holden & Karsh, 2010) that assesses the acceptance of an innovation. The acceptance depends on the attitude towards the innovation. The attitude can be either positively or negatively influenced by how professionals perceive the usefulness and the ease of use of the innovation.

To assess the acceptance of PHRs by GPs, semi-structured interviews were conducted with GPs, acting GPs and a nurse practitioner. This research focused on the motivations to adapt or not adapt PHRs. In order to gain more in-depth insights, a selection was made for professionals who had already experience with patient-supporting applications or actively gained knowledge about eHealth. Therefore, the participants were able to comment on their experiences, what functionalities desirable and the existing concerns.

In preparation of the interviews, an interview guide based on TAM was created. All the participants received an information letter in advance with information about the study and PHRs in general. The interviews took about an hour each and were tape recorded.

For the analysis of the interviews, all the audio tapes were transcribed and coded. These codes allowed for identifying interactions between concepts. Based on this, an advice for prerequisites could be established.

The analysis of the interviews identified a positive voice towards PHR adoption among the participants of this research. However, several obstacles were identified that need to be addressed before implementation can be realized.

The participants see an added value of a PHR that it enhances both the work efficiency and work quality. This can be realized by more input from the patient. However, this input from patient-generated data requires some attention regarding rules for input. Additionally, the data should be shown in a structured manner. This will help to provide better insights in the medical situation of the patient makes data analysis possible. The monitoring of data provided by patients does raise the concern who is responsible for monitoring.

The use of PHRs may require some changes in the existing practices in general practices. If necessary, these changes should be guided during the adoption phase.

The adoption of PHRs by GPs could be successful, as the general attitude towards PHRs is positive among the participants of this study. However, this study used a selective participant group, since the most participants have already experience with patient-supporting applications. To create a complete advice on PHR integration, the participant group could be extended with non-experienced GPs and other medical professionals. Furthermore, to make PHR adoption successful, the perspectives of other actors, such as patients and eHealth suppliers, should be considered as well.

Some aspects of PHRs and its implementation require attention. This mainly concerns the structure of information, to overcome the records from being polluted. The development of standards for data input and analysis could be developed in collaboration with GPs. Furthermore, attention should be paid to make the PHRs fit in in the work processes of GPs. It seems that change is the work process is probably unavoidable when PHRs are adopted. Therefore, guidance during the adoption and implementation phase might be necessary.

List of Abbreviations

EHR	Electronic Health Record
GP	General Practitioner
HIS	General Practice Information System
ICT	Information and Communication Technologies
IT	Information Technology
PHR	Personal Health Record
TAM	Technology Acceptance Model

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Chapter 1 Introduction

Information processes become more and more digitalized. This trend is also seen in the medical field in the form of 'eHealth' technologies. Studies showed that these technologies have several advantages for improving healthcare quality (Elbert et al., 2014; Sheikh et al., 2016). For example, eHealth benefits the monitoring and self-management of patients (Elbert et al., 2014; Ossebaard & Van Gemert-Pijnen, 2016).

Different forms of eHealth services are already widely used (Goldzweig et al., 2013). An example of this are patient portals, which are provided by healthcare organizations to give patients online access to their medical data from medical professionals. However, these portals are often used on a small scale, limited to only one healthcare provider or target audience, which negatively affects the use by patients (Goldzweig et al., 2013).

Nowadays there is a trend towards more integrated and patient-centered eHealth services, in order to strengthen the information position of patients (Schiza et al., 2015). A current development, in line with patient-centered eHealth services, is the use of Personal Health Record (PHR)[1]. In contrast to patient portals, a PHR should consist of multiple integrated eHealth services, where the user can not only view their medical data but is also able to add information themselves, such as a diary or self-measurements (blood pressure, weight, blood glucose levels).

Furthermore, the application aims to provide tools that facilitate communication between patient and healthcare provider. A PHR should be a universally-accessible, easy-understandable and user friendly application, that can be used by not only patients, their caregivers and their healthcare providers, but also by healthy individuals to make it a lifelong relevant tool. The healthcare user will manage his or her own data and decides what information will be shared and with whom (Nationale Patienten Consumenten Federatie, 2015).

Experiences with pilot PHRs show that patients see it as a tool that creates overview, helps to take control over their personal health, and contributes to the communication with healthcare providers. It creates insight, a sense of freedom, peace of mind and trust (Ervaringen, 2016). A PHR collects data and services about health and healthcare in support of self-management. With this it strengthens the information position of people concerning their personal health (Persoonlijke gezondheidsomgeving, 2016).

Although one of the main aims of PHRs is to strengthen the information position of patients, not only patients should be able to use a PHR. It can also be an added value in the professional field, by enhancing the communication between patient and healthcare provider (Krijgsman & Klein Wolterink, 2012). Furthermore, PHRs can give healthcare providers a more complete picture of the medical situation of the patient and thus enables better monitoring (Uhlig et al., 2013).

To make optimal use of its potential, the medical professional should also be able to use a PHR; the tool should be adjusted to the needs of medical professionals as well. Therefore, this study focuses

[1] In Dutch: Persoonlijke Gezondheidsomgeving (PGO)

on the professional's perspective. This concerns the usability of data entry and the structure of information (Walsh, 2004). One study looked at the perspective of healthcare professionals towards PHRs (Huba and Zhang, 2012) However, this study only assessed the patient-generated data aspect of PHRs.

Recently, several pilots with PHRs in general practices started in the Netherlands (Duijvendijk, 2017). However, it is still unclear how PHRs should be integrated in the information and work processes of general practices, and what the prerequisites for acceptance by general practitioners (GPs) are. Therefore, the aim of this research is to identify the prerequisites that allow GPs to use and integrate PHRs in their information and working processes. This will be done by making an inventory of the aspects that are affected when integrating PHRs in the information processes of general practices. Leading to the following research question:

How can PHRs be integrated in the work and information processes of general practices, to make PHRs usable and an added value for GPs?

Chapter 2 Contextual Background

2.1 Personal Health Records

There is no uniform definition of PHRs described in literature. For this study, the definition described by the Patiëntenfederatie Nederland is used. A PHR should provide an environment that gives lifelong support to individuals on health, providing overview, insight and involvement in their own health. It should enable individuals to collect, manage and share health-related information. Furthermore, a PHR should support self-management and empower them to make the right choices concerning their own health (Nationale Patiënten Federatie, n.d.; Van Pelt, 2015).

A PHR provides the ability for patients and other individuals to input information themselves, such as self-measured blood sugar levels or a headache journal. In order to make a PHR a lifelong supporting environment, any health-related data can be added, for example information about diet or sports activities, but also medical records maintained by medical professionals. The user decides what information will be added to the PHR are and what information will be shared with others (Nationale Patiënten Federatie, n.d.; Van Pelt, 2015).

PHRs should provide patients with a better information position, since they have better insights in their own medical situation and have the ability to control their data. Furthermore, when integrated sufficiently in the medical information processes, a PHR might also be beneficial to clinicians. For example, a PHR can provide the opportunity to monitor a patient's continuous measurements. Therefore, PHRs can enhance not only the communication between patient and healthcare providers, but also give better insights into a patient's health situation (Nationale Patiënten Federatie, n.d.). An overview of possible PHR functionalities is shown in Appendix A Inventory of PHR options.

2.2 Advantages of integrating PHRs in the information processes of the medical field

As shown in Appendix A Inventory of PHR options, a PHR can provide many different functionalities. A number of advantages a PHR can provide for GPs will be explained in this section.

Self-measurements of patients outside the clinical setting can be monitored by clinicians with the help of PHRs. This monitoring helps to recognize fluctuations better and in an earlier stage. The importance of these self-measurements was shown in a study by Uhlig et al. (2013). This meta-analysis showed that monitoring of self-measured blood pressure levels lowers blood pressure in adults with hypertension on the short-term. A lower blood pressure is associated with a decrease in mortality rates due to among other strokes or chronic heart disease (Uhlig et al., 2013).

Another beneficial aspect of monitoring self-measurements is that it allows for better and more specific medication, overcoming under- or overtreatment (Uhlig *et al.,* 2013).

PHRs give the opportunity to improve the communication between patients and healthcare providers, for example by facilitating online consults (eConsults). A PHR can create a secure setting for such contact, which enables the patient to send pictures for example. Furthermore, a medical professional could also guide the patient outside the professional setting by providing information via the PHR (Krijgsman & Klein Wolterink, 2012).

2.3 Information processes in general practitioner practices

In the Netherlands, all GP offices use information systems that enable them to keep track of patient records, prescribe medication and facilitate the financial processing with health insurances. This is called a 'General Practice Information System' (HIS)[2]. Part of the HIS are the Electronic Health Records (EHRs), the records where medical information of a patient is stored. Although the patient can request the information from a EHR, patients are not able to add information themselves (Huisartsinformatiesysteem (HIS), n.d.; Het elektronisch huisartsendossier (H-EPD): Toekomstvisie Huisartsenzorg, 2012).

2.4 Challenges for integration of PHRs

A study by Huba and Zhang (2012) showed that medical professionals consider the information provided by patients via PHRs valuable. However, they point out that different specialties are interested in different types of information. Which specific information GPs require has not yet been explored. This study by Huba and Zhang (2012) also identifies several concerns medical professionals have regarding information sharing through PHRs, including patient privacy and the quality of the retrieved information. Furthermore, there are still issues with the operability of EHRs and PHRs. To be able to integrate PHRs in the information processes of general practices, the possibilities of creating a link between the current systems (HIS) and PHRs need to be explored, as well as the legal boundaries concerning information sharing between EHRs and PHRs (Huba and Zhang, 2012).

[2] In Dutch: Huisarts Informatie Systeem

Chapter 3 Theoretical Background

In this section, the conceptual framework used during this research will be explained, as well as the determinants that operationalize the concepts of the framework. Several sub questions can be derived from the framework.

To be able to give a complete advice on the prerequisites for integration of PHRs in the information and work processes of general practices, the use and acceptance of PHRs by GPs will be assessed. For integrating PHRs in information systems involves technological challenges as well. Because this study only examines the perception of GPs towards PHRs, the technological challenges are considered out of scope.

3.1 Technology Acceptance Model

The Technology Acceptance Model (TAM) first described by Davis (1986), examines the use and acceptance of information technology (IT) (figure 3.1). Studies show that TAM can predict the acceptance and use of IT in healthcare (Hu et al., 1999; Holden & Karsh, 2010).

This model shows that the actual use of IT technologies can be predicted by the individual's motivation or willingness to use the technology. This is called the behavioral intention. The behavioral intention depends on the individual's judgement about the concerning behavior, that can be either positive or negative on some dimension (e.g. pleasant/unpleasant).

The attitude towards a certain behavior is affected by the individual's perceived usefulness of the technology, which relates to the content of the application. Perceived ease of use can be explained as the perception of an individual if the technology will enhance job performance. In this case, it is also explained as to which extend the application is relevant for an individual's profession.

Furthermore, attitude is affected by an individual's perceived ease of use, which relates to the usability of the application. Perceived ease of use can be explained as the perception of an individual if the use of the technology will be free of effort. The relation between perceived usefulness and perceived ease of use indicates that when a technology is easier to use, this will increase the usefulness (Holden & Karsh, 2010).

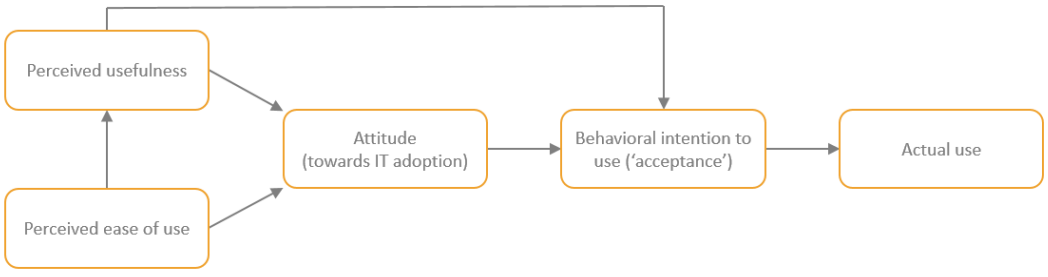

Figure 3.1. Technology acceptance model (TAM), first described by Davis (1986). The perceived usefulness of an application can positively or negatively influence an individual's attitude towards IT adoption. The same applies to an individual's perceived ease of use of the application. Thereby, the perceived ease of use can also positively or

negatively affect the perceived usefulness. When the attitude towards an application is positive, it enhances the acceptance towards the application, leading to actual use of the application.

3.2 Operationalizing the conceptual framework

One aspect of importance for the perceived ease of use of PHRs is usability. Usability is defined as 'the degree to which something is able or fit to be used' (Usability [Def. 1], n.d.). To make PHRs usable for GPs, the usability of the tool must comply with the values of GPs. In order to assess the usability, the nine principles of electronic medical record systems by HIMSS are used (HIMSS EMR Usability Evaluation Guide for Clinicians' Practices: 9 Essential Principles of EMR Usability, 2015). These determinants are explained in table 3.1.

Table 3.1. The determinants for the perceived ease of use, based on the HIMSS EMR Usability Evaluation Guide for Clinicians' Practices: 9 Essential Principles of EMR Usability, 2015.

Determinant	Definition
Simplicity	No unnecessary information or visual elements, clear and clean user interface, functionality limited to essentials.
Naturalness	Application is intuitive and easy to get familiar with, workflows match the practice.
Consistency	Consistent use and placement of screen elements, all different parts have the same look and feel, consistent use of language.
Forgiveness and Feedback	Data will not easily be destroyed or deleted by wrong choices or clicks, application helps to avoid mistakes, application provides information about actions.
Effective Use of Language	The application uses profession-related terminology, clear and unambiguous entry-forms, sentences read naturally in selected language.
Efficient Interactions	The number of steps to take for completing tasks is minimized, navigation options (shortcuts e.g.) for routine actions are provided, navigation methods minimize user movements.
Effective Information Presentation	Sufficient use of white-space and fonts to read information easily and with high comprehension, colors are used to convey meaning.
Preservation of Context	Screen changes and visual interruptions are minimized while performing a particular task.
Minimize Cognitive Load	Information concerning a particular task is grouped together, alerts are clear and informative

Liang et al (2003) studied an extended version of TAM in healthcare and describes the availability of support as another influencing factor for an individual's perceived ease of use. Support is defined as the degree to which technical assistance and resources are provided on request of the user.

Also, Liang et al (2003) describe job relevance as an important factor for the perceived usefulness. They define this as the degree to which the application is applicable to the professional tasks of the user.

Another determinant for perceived usefulness concerns the degree to which the application enhances work efficiency. In this case efficiency is defined as the perception that job performance will be easier, while decreasing the time in which tasks are performed (Holden & Karsh, 2010).

Furthermore, the degree to which the application enhances work quality also affects the perceived usefulness. This is described as improvement in quality and safety of care (Holden & Karsh, 2010). The key concepts of the conceptual framework and the factors of influence are summarized in table 3.2.

Table 3.2. Key concepts for the framework for integration of PHRs in information systems of medical professionals. The determinants are based on several studies that use the same concepts. These determinants are used to assess different aspects of the concept (Holden & Karsh, 2010; Liang *et al.*, 2003).

Concept	Definition	Determinants
Perceived usefulness	The perception of an individual that the technology will enhance job performance (Holden & Karsh, 2010)	▪ Job relevance ▪ Enhances work efficiency/productivity ▪ Enhances work quality
Perceived ease of use	The perception of an individual that the use of the technology will be free of effort (Holden & Karsh, 2010)	▪ See table 3.1 ▪ Support

Sub questions

Several sub questions can be derived from the conceptual framework:

- What are the factors behind the adoption of PHR by GPs?
- What aspects enhance the perceived ease of use of GPs towards PHRs?
- What aspects enhance the perceived usefulness of GPs towards PHRs?

Chapter 4 Methods

This chapter explains the research approach, participant groups and methods that were used in order to gain insights on the motivations behind the adoption of PHRs by GPs.

4.1 Research approach

Because the general view of GPs on PHRs was unknown, this study followed an inductive approach. To be able to create an advice on how to integrate PHRs in the information systems of general practices, the motivational factors towards IT adoption were examined using qualitative methods. GPs were questioned by conducting semi-structured to obtain insights into the perceived usefulness an ease of use of PHRs.

4.2 Interviews

During this study, semi-structured interviews were conducted. This style of interviewing makes use of a topic list, to ensure all the important topics will be evaluated, but still gives room for additional questions and probing (Gray, 2014). A semi-structured approach is chosen because there are several concepts that should be assessed, but the new ideas and perspectives are of great value as well. To retrieve in-depth information, probing is necessary. In order to examine all the important topics, an interview guide with relevant questions and probing question was created (Appendix B Interview Guide) (Verschuren & Doorewaard, 2010). This interview guide is based on the concepts of the conceptual framework described in the previous chapter.

The interviews took place at a location most convenient for the participant. The interviews had a duration of approximately one hour. To make sure every participant had sufficient understanding of the subject to answer the interview questions, they received an information letter before the interview (Appendix C Information Letter). This information letter contained information about the current state of PHRs. Additionally, the information letter contained examples of possible functions a PHR could comprise, to give the interviewee a sufficient understanding of the possibilities of PHRs. Although in preparation of the interviews there was some discussion if this information would inhibit the devising of new and creative ideas by the interviewee, it helped the participants to create a clear image of what a PHR could be like. Because there has not been a complete PHR developed yet, it was deemed important that the interviewees received sufficient information on PHRs, to have a basic picture of the application.

Participant group

A cross-sectional study was performed among different actors that are involved in general practices. The first interviewee group are GPs. Interviews were conducted with GPs who already had experience with the use of patient supporting applications or were preparing to use these tools. This selection was made to ensure the participants had some basic knowledge about these applications, and thus had an idea of its implications. This approach enabled the GPs to give more in-depth comments on PHRs and their expectations of the product. This also enabled them to express their expectations and still existing concerns.

A distinction was made between GPs and acting GPs[3]. Acting GPs are in this case GPs who work in several practices in a certain region. Because these GPs work in different practices they will generally not have a relationship with the patients and may therefore have different interests.

Furthermore, a nurse practitioners[4] was interviewed. In this case only a nurse practitioners who works in a general practice was selected, because other specialists are out of scope for this study.

An overview of the participant group can be found in table 4.2. The participants were mostly located in the middle and south of the Netherlands, working in urban and suburban areas, only one participant was located in the north.

Participant recruitment

Recruitment of GPs took place through contacts of Nictiz. Furthermore, an advertisement was placed on 'HAWeb', an online platform for GPs. The nurse practitioner was also contacted through contacts from Nictiz. The number of participants was determined based on their availability and until data saturation was reached (Malterud, 2016).

The research focused on data saturation for GPs. The nurse practitioner is considered an additional interviewee group, included to retrieve different perspectives within the practice. Nurse practitioners are an interesting addition, because they work often with chronically ill patients, for whom self-measurements might be particularly interesting.

Table 4.2. Overview of the participant group.

Role	Number
General practitioner	6
Acting general practitioner	2
Nurse practitioner	1
Total	*9*

Reliability & validity

During the interviews, notes of statements that were considered important or notable were taken. To ensure any environmental influences could be taken into account, the context of the interviews was described as well. Additionally, the interview was tape-recorded to keep the reliability high (Gray, 2014).

In order to ensure good interpretation, and thus reliability, a member check was performed. A summary of the interview was sent to the interviewee afterwards, to enable them to check if their statements were interpreted the way they intended.

With the information letter the interviewee was assured of confidentiality. Before the interview started it was emphasized that there are no wrong answers and every perspective was valuable, to overcome the participants from answering with which they think were desired answers (Gray, 2014).

[3] In Dutch: Waarnemend huisarts
[4] In Dutch: Praktijk Ondersteuner Huisartsenzorg (POH)

Chapter 5 Data Analysis

After the interviews were performed, the collected data was analyzed. In this chapter, the analysis of the interviews will be explained. Based on the results of these methods, an advice on prerequisites for PHRs, that allow for integration of PHRs in the information processes of general practices, was formulated.

5.1 Analyzing the interviews

The following described steps for analyzing the interviews were done for the interviews with GPs, acting GPs and the interview with the nurse practitioner separately, in order to identify possible differences between the different occupations.

Transcribing the data

The interviews were recorded to allow for word-for-word transcription. The transcript of the interview allowed for familiarization of the data in an early stage. Also, notes made during the interview were analyzed. Both these sources of information were needed for further analysis of the data (Gray, 2014).

Coding

The coding process started directly after transcribing the first interview and consisted of different phases (Gray, 2014). To structure the coding process, the software QDA Miner Lite was used (Provalis, 2017).

The analyzing process started with reading the transcripts and notes without interpreting the data. During this phase, new concepts emerged from the data (open coding). These new concepts and the concepts described in the conceptual framework were integrated in an open coding framework (Appendix D Coding framework). This framework was used in the further phases of the coding process.

In the second phase of the coding process the text was labeled with keywords to compare the different interviews. After labeling, connections were made between different concepts, in order to find interactions between the concepts (axial coding).

Finally, a list with core categories was established based on the concept interactions of the second coding phase (selective coding). These core categories became the basis for formulating prerequisites.

Chapter 6 Results

This chapter elaborates on the findings retrieved from the interview data. The conceptual framework described in chapter 3 was used to generate the results and provided the basis of the data analysis process. The framework describes two main concepts: perceived usefulness and perceived ease of use. The results of both these concepts will be discussed. New aspects that emerged during the interviews will be elaborated on as well.

Interviews were conducted with nine participants. An overview of the demographics of the participants can be found in table 6.1. All participants were experienced with some form of patient-supportive applications, or already acquired knowledge about this. Table 6.2 shows an overview of the applications used by the participants.

Table 6.1. Demographics of the participants and the practice where they work.

Participant	Occupation	Sex	Location of practice	Patient population: Age (average)	Patient population: Education level (average)
01	GP	Male	Urban	Mixed	Not Available
02	Acting GP	Male	Several	Not applicable	Not applicable
03	GP	Male	Suburban	Mixed	High educated
04	GP	Male	Urban	Mixed	Mixed
05	GP	Male	Suburban	Elderly	Mixed
06	GP	Male	Urban	Young	High educated
07	Nurse practitioner	Female	Rural	Elderly	Not available
08	GP	Male	Rural	Mixed	Mixed
09	Acting GP	Female	Several	Not applicable	Not applicable

Table 6.2. Overview of the eHealth applications used by the participants of this research. The acting GPs work in multiple practices and are therefore included in this table based on their experience with the applications.

Activity	Total number of participants (n=9)
eConsults	7
Online appointments	6
Repeat prescriptions	6
Lab results	3
Self-measurements	1

In general, the participants involved in this study were positive towards using PHRs for facilitating communication and sharing information with patients. However, several obstacles and concerns involving PHRs emerged during the data collection. This will be discussed in the following sections, starting with the basis of the conceptual framework, followed by new concepts.

6.1 Perceived usefulness

As described in the conceptual framework, the concept perceived usefulness includes the aspects 'work efficiency' and 'work quality'. The aspects will be further explained in this section.

Enhancing work efficiency

A main reason for adoption of PHRs, mentioned by the participants, would be the possibility to enhance the work efficiency. For example, by retrieving more information from the patient before consultation. With this approach the complaint can be clear in advance, which saves time during the face-to-face moment with the patient. The time gained can be spend on performing physical examination, providing advice or, as one participant said, simply asking *"How are you?",* (Participant 01, GP). However, one participant mentioned that even though it is helpful that patients are prepared before consultation, it is also valuable when patients are not too informed when they come for consultation. This is because the GP regularly wants to know how the patient feels about the complaints and if he or she is worried: *"Very often you do not have to do anything as a GP - it is more a job of reassurance […] It should not become too clinical",* (Participant 09, acting GP). Although another participant had a contradicting view and values this preparation by the patient: *"I like it when patients write down what they are coming for, then you already have an idea what the patient means and that is often much more extensive than the assistant would ever write down",* (Participant 08, acting GP).

Several participants indicated that work efficiency can also be enhanced after the consultation; participants stated that it often remains unclear to the patient what was discussed during consultation. If patients can read back the treatment policy and what was discussed during consultation, subsequent uncertainty can be prevented. Apart from information about the treatment policy, there are multiple ways the GP delivers information to the patient. AAppendix E Result tables, table E1 shows an overview.

Besides before the consultation and after the consultation, different moments where a PHR can be beneficial for work efficiency were identified, this is shown in figure 6.1.

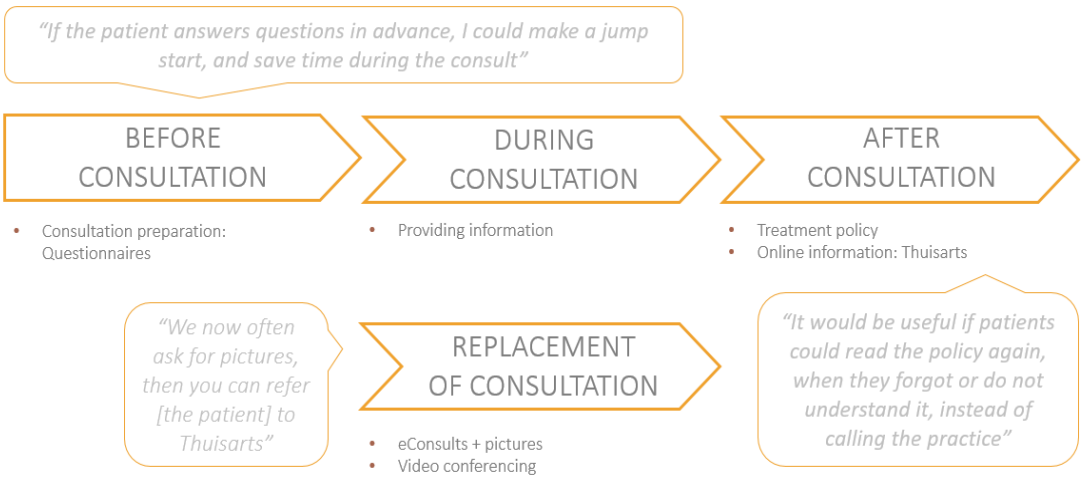

Figure 6.1. Overview of the opportunities a PHR can provide regarding enhancing consultation efficiency, shown at different moments related to consultation. Before consultation, preparation of the consultation was considered

most important. Information about the patient's complaint can be retrieved in advance with the use of questionnaires. If the complaint is clear before consultation, this might save time during consultation. This gained time can be spend on providing information to the patient, making sure the patient leaves confident and with enough knowledge, reducing the need for contact after consultation. In addition, if the patient can view the agreed treatment policy after the consultation, this might also help patients to understand their medical situation. Also, the GP can provide reliable online information through the PHR, for example with Thuisarts[5]. Furthermore, a PHR can support consultation replacement. Answering questions via eConsults might not take ten minutes, which again saves time.

Direct contact through a PHR with patients can also be beneficial for dealing with questions after consultation. For example with the use of eConsults. Instead of calling patients back or planning a consultation, some questions can directly be answered through a secure message service. An overview of the ways a PHR can facilitate in interaction with patients can be found in Appendix E Result tables, table E2. This includes video conferencing. Although some of the participants would like to try video consultation, a few thought this would not be a solution because it would not have many more advantages over telephone contact, which is already sufficient.

Participants indicated that these new forms of interaction and renewal of consultation time require some changes in the daily practice. For example, instead of normal consultations, time should be scheduled for eConsults. Also, there might be more time needed for consultation preparation, but this will still provide more time that can be spend with the patient.

Enhancing quality of care

Another important reason for PHR adoption, which clearly emerged during data analysis, is that it offers opportunities to improve the quality of care. Participants indicated that this is strongly related to the work efficiency. If there is a way to save time during the consultation, time that can be spend on and with the patient, there is more time to figure out underlying causes of complaints and act on this.

More information from patients can also give better insights in their medical situation. Together with questionnaires, diaries and self-measurements can provide a better overview and the chance to show the medical situation over time. More frequent measurements give the ability to better visualize trends. This can help to detect abnormal measurements easier and be able to act more rapidly on this. A summary of the ways a patient could provide information to the GP is showed in Appendix E Result tables, table E3.

A good overview of data was mentioned as very important for the quality of care. A participant stated: *"I want an overview. And if I have an overview, I sometimes want insights",* (Participant 03, GP). There was especially a strong request for medication overview. The participant explained: *"I think it is very important that the patient checks with [a PHR] what is true in his file. I mean medication in particular, it appears to be a big problem and we are not getting it fixed, that is very frustrating. […] Currently the patient has no opportunity to check [their medication information], while he is the only one who knows what is true. I know what I prescribe, the pharmacy knows what he delivers, the patient knows what he*

[5] Thuisarts.nl is a website that provides reliable, independent information from GPs about health and disease in comprehensible language. Thuisarts is already often used by GPs to provide information to their patients (Thuisarts, n.d.).

takes. If you match those three things, then there is a big chance that we have the truth", (Participant 03, GP). Another participant valued this insight by patients in their medication overview as well, but was critical about patients being able to review their medical history: *"I notice that people tend to forget things. Correcting something that recently happened is much easier than something from the past, history is more difficult. But it would be good if patients can add details that were missing in the file although it is essential information",* (Participant 09, acting GP).

Self-management

Another possible value of PHRs mentioned by the participants is the improvement in self-management of patients. When patients have the ability to view their medical records and provide information themselves, they can have better insights in their health situation, they can be more involved in formulating the treatment policy and will therefore be more motivated to undertake action for their own health. As one participant stated: *"We are looking for all sorts of possibilities to involve the patient, so I would like for patients to keep track of their personal records […] I think it is the only way to make sure my advice for behavioral change is experienced as a shared decision",* (Participant 03, GP).

Several participants thought better self-management by patients and more shared-decision making will change the role of the GP, making the GP no longer the authority: *"I think our roles will change dramatically. The doctor does not solve the problem, he gives advice. [The patient] is in control and the doctor is watching from the sideline",* (Participant 08, GP).

A concern some participants discussed was that online contact should not be the default. It should exist next to telephone contact. Otherwise people who are less digitally skilled, such as elderly, will be left out. Several GPs often come across patient who are not sufficient in the Dutch or English language or experience other barriers that might make using a PHR difficult. One GP explained: *"We have to watch out for the possibility that there might be a group formed in society that misses out because everything is digitalized. Offline will become a smaller part, but you have to keep providing that as well",* (Participant 06, GP).

6.2 Perceived ease of use

The concept 'perceived ease of use' examined the opinion of the participating GPs on how information and the functionalities of the PHRs should be integrated, visualized, and used within their systems and work processes. This section elaborates on different aspects of this concept.

Integration of PHR data

From the interviews, two main ideas emerged about PHR data integration into the HIS. A separate tab within the HIS was mentioned as a possibility, some participants thought the measurements should be separated and only integrated on request. However, most participants were open to full integration of the self-measurements with the measurements conducted during consultation. This allows for a complete overview of the measurements, as one GP said: *"I do not want to have a tab for blood pressure values measured by the patient and another tab for values measured by me, I would like to see that in one graph"*, (Participant 01, GP).

There are different values acceptable for at home measurements and measurements in a professional setting, due to the stress a professional setting may cause. Therefore, it is considered

important that the source of the measurement is clearly indicated. Furthermore, strict rules to self-measurements are desirable to overcome pollution of the data. This concerns for example the quality of the measuring equipment used at home.

Visualization of PHR data

As described in the previous paragraph, self-measurements could be integrated in the measurement data in the HIS, provided that the origin is clear. The participants mentioned that the measurements should be visualized in graphs or figures, as only a list of values does not provide enough information.

Most participants mentioned that all the input should be as structured as possible, avoiding free text because this might take too much time to read, does not provide enough overview and is difficult to analyze. One participant explained that this is also applies for diaries: *"I would like to have diaries as structured as possible, with multiple choice options and numbers. Prose is very complicated, of course there must be a free text field, but with a diary you look at how it is going day by day, so you can see trends for example, that would be very difficult with free text",* (Participant 01, GP).

Another very important advantage of structured data pointed out by the participants, is the possibility it gives to see the course of the medical history over time. PHRs give the opportunity to integrate different data sources, giving a chance to create a timeline of the patient's medical history per episode. As previously described, overview is considered an important value of a PHR. One GP described how this overview in time should look like: *"I want to zoom in at a moment in the medical history to see what was relevant at the time. I want to see at a glance what medication the patient uses and what alterations there have been. I want to see at a glance what medical care providers are involved and whether they are still active. I really want to get a quick insight into what is going on and that is only possible if you show it over time. You could create a time bar, preferably horizontal, with marks when something has happened, such as physiotherapist referral. If the event is still active, the mark will still continue. That would be a big help",* (Participant 03, GP)

During the interviews the question of how the GP should be notified about new information arose. It is thought that when patients can provide information, there will be new information available more frequently. In general, GPs do not want to have to look for new information, so notifications are in place. However, the participants mentioned not all information in relevant. They explained that most of the time you only want to see it right before the patients comes for consultation, when limit values are exceeded or when there are other noteworthy differences in the measurements.

In addition to notifications for self-measurements, some participants expressed the concern of responsibility. It is a difficult question whether the GP is responsible for monitoring and should act if the measurements differ from the standard. Although a deviation in the measurements might not be dangerous in a particular context, you can never be sure that nothing happens: *"By the time the patient accidentally gets something serious, you have seen that notification but did not do something with it",* (Participant 08, GP).

PHR in the work processes

One of the interview questions dealt with the support for using PHRs in the practice. Although this question was mainly focused on technical support and education, a number of GPs mentioned difficulties

with the integration in work processes. This relates to the 'naturalness' aspect of usability. All GPs involved in this study independently indicated that they are dealing with a lack of time. The practices are busy and in many cases their consultations only take ten minutes. Unless an innovation is free of effort, this gives often no room for adoption of new work processes, or as one GP explained: *"We do not have time to think about innovation and how to improve the care we provide. Everyone is constantly in the front line, taking office hours or making calls, there is no room for introducing new work styles. There must be attention, time and money for the implementation of new styles of work",* (Participant 04, GP)

A point of concern is the use of language by GPs when they keep track of records. With a PHR patients might be able to view their medical records in the HIS. All participants agree that this information should be understandable for patients. However, there is a difference in opinion on how this should be accomplished. This concern also relates to 'naturalness'. For the usability it would be beneficial if the medical professional can keep using their own language and jargon, using professional and medical terms and suppliers of PHRs should make a translation format. One participant explains: *"If you change your style of writing you have to take into account the lowest language levels, because you want everyone to be able to understand, so where do you set that limit? The story will never be complete because you have a lot of different levels of knowledge about health, not to mention people with language barriers",* (Participant 02, acting GP). Another participant thinks a format will not be the solution and commented that GPs do have a responsibility in this and should put some effort in making the records understandable for patients. Although the GP reckons that you can probably not make it understandable to everyone and some terminology cannot be avoided. It was mentioned that for example Thuisarts can give the explanation if information in the medical records is unclear.

Technical and educational support for the tool were considered less important if the tool is intuitive and easy in use. Several participants thought this would be possible if medical professionals are actively involved in the development and implementation process. One GP mentioned that the support that would be provided should be independent, because of the commercial interests of the suppliers. Another participant expressed the need for an online forum thread for users, similar to the forum threads available for HIS users.

Furthermore, there is a request for a helpdesk for patients provided by another party. This is currently often lacking for portals, patients then contact the practice for technical questions, although these are questions for the supplier.

Chapter 7 Discussion

7.1 Principal findings

During this research an inventory of the aspects involved in PHR adoption by GPs was made, in order to develop an advice for PHR integration in the information processes of general practices. This study showed that PHRs are considered to improve the consultation efficiency and the quality of care, provided that data is displayed in a structured manner, and there is time and space to implement PHRs in the work processes of GPs.

The analysis of the interviews showed that the participants of this study are generally positive towards PHR adoption. The participants mainly see added value of a PHR in consultation preparation, for example with the use of questionnaires. This information saves time during the consultation, which can be used to identify the cause of the complaint and on providing care and information. Also, the information provided after consultation was considered valuable, because it gives patients a reference to the consultation, with for example a summary of direct links to relevant Thuisarts pages or insights in the arranged treatment policy. When patients have these insights, this might lead to a better understanding and subsequently less questions or need for contact after the consultations.

All of these arguments are thought to enhance consultation efficiency. Furthermore, quality of care can be improved, if there is less information to process during the consultation, the saved time can be spend on providing care. Also, better understanding of the treatment policy can help patients to follow the treatment policy more accurately, reducing health risks (*Ricciardi et al.*, 2013).

This research showed a relationship between work efficiency and work quality, which in this context is the quality of care delivered by the healthcare professional. A study by Baker (2001) describes the same relationship. In this study, the quality of care is divided in different components including efficacy. This component is accompanied by equity, timeliness, safety, effectiveness and patient-centeredness. The latter is particularly interesting in the context of PHRs. As PHRs aim to be patient-centered, this again indicates the tool can enhance the quality of care (Ossebaard & Van Gemert-Pijnen, 2016).

Another important functionality of PHRs is the input of patient data such as self-measurements. These were also considered to improve the quality of care, by giving more continuous measurements that can be monitored over time. However, it is important to determine to what extent the GP is responsible for monitoring these self-measurements, since this can become complicated in legal matters.

The input of patient data must be controlled, to overcome pollution of the medical records and to avoid an overflow of data. Furthermore, the participants showed a preference for displaying data chronologically, at least per episode, to give more insights in the medical history and progress.

Initially it was thought that PHRs can boost self-management of patients. Participants indeed thought that when patients are able to manage their own data, the interest in their own health will increase and patients will be more motivated to improve their health. This could lead to a change in the role of the medical doctor, from an authoritative role to a more advisory function.

According to the participants, better self-management has another advantage. When patients have more insight in their medical data, they can evaluate their medical history for inaccuracies, for example the information about medication intake. Although, it must be realized that patients are not always able to recall events that happened a relatively long time ago.

Huba and Zhang (2012) also showed a similar strong request for a good medication overview. Additionally, a recent study by Patiëntenfederatie Nederland showed that the number of hospitalizations due to medication errors increased to 49.000 on a yearly basis (Veldman, 2017). This concerns in particular elderly who take incorrect doses of medication or have reactions to dangerous combinations of medication. A previous study showed that patients want to play an active role in preventing medication errors (Eindrapport: Vervolgonderzoek Medicatieveiligheid, 2017; Veldman, 2017). A PHR could potentially be the ideal platform for this.

Although the participants were positive towards the adoption of PHRs, the actual implementation might be challenging. Because of the lack of time, GPs experience difficulties with introducing new workstyles in their practices. The participants indicated that should be taken into account during development and might require guidance during the implementation phase.

The issue of adapting work styles in a hectic work environment fits with the multi-layer model of interoperability[6] (figure 7.2.1). This model is used for implementation of eHealth technologies. Interoperability is important for effective and safe data sharing between healthcare providers and patients (Wat is interoperabiliteit?, n.d.). One of the aspects of interoperability is the alignment of care processes. This also applies to the work processes of GPs. Changes must be made to the working procedures to embed PHRs in the daily working practice.

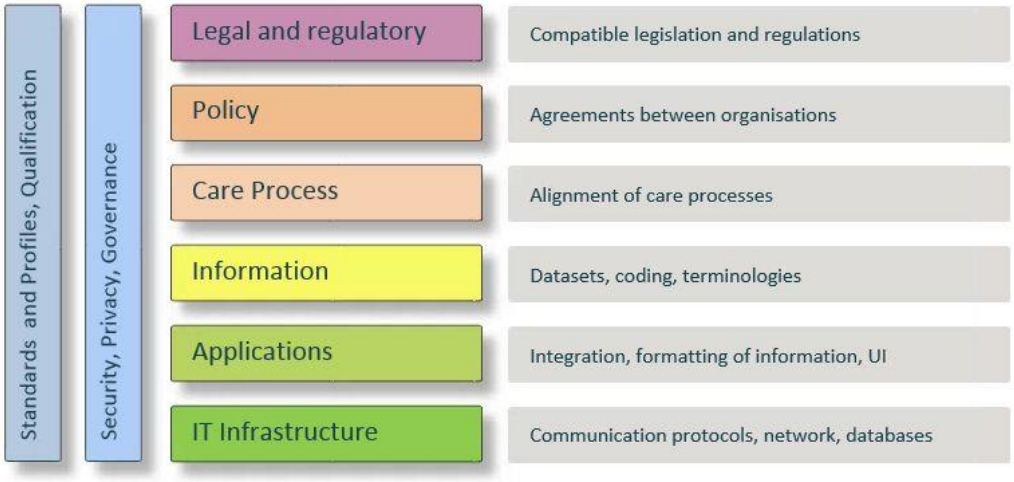

Figure 7.1.1. Multiple layer model of interoperability (Van Pelt, 2014).

[6] Definition interoperability: The capability to communicate, execute programs, or transfer data among various functional units in a manner that requires the user to have little or no knowledge of the unique characteristics of those units (ISO/IEC 2382:2015(en) Information technology — Vocabulary, 2015).

A study by Schaper & Pervan (2007) addressed this issue as well. They assessed IT adoption among occupational therapists by the means of TAM. Their study showed the importance of innovations to be consistent with the existing practices of professionals. If change is the work processes is unavoidable, this should be taken into or account and guided when necessary.

Finally, it is important to realize that not all patients will be able to use PHRs, due to a lack of digital skills for example. Therefore, a PHR should not be the only option for contact with GPs, the current methods should be available simultaneously. If digital methods are the only option, the risk exists that groups in society will be left out. Although a PHR can provide a better information position for many people, for the less digital skilled people it might actually deteriorates their information position if they have no other option than to use PHRs.

7.2 Review of the conceptual framework

The presented conceptual framework, TAM (figure 3.1), showed that the attitude towards a certain innovation, in this case PHR, depends on the perceived usefulness and ease of use towards the innovation. The perceived usefulness can be influenced by the perceived ease of use as well.

This research showed that the perceived usefulness is generally positive among the participants, both the aspects of work efficiency and work quality were extensively discussed during the interviews, pointing out a positive influence on the attitude. Although not presented in the framework, these aspects seem interrelated, where work, or consultation, efficiency enhances work quality.

The direct influence of perceived usefulness on the behavioral intention to use the tool was not clearly identified. Nonetheless, several participants expressed a strong request for several PHR applications, for example the ability to retrieve self-measurements, indicating they are willing to use these applications immediately.

The participants in this study expressed more concerns for the ease of use than for the usefulness of PHRs. Most obstacles that were identified during this study relate to the ease of use, mainly about the presentation of information. However, the participants did not indicated that these challenges cannot be tackled and were actively elaborating on possible solutions. If these obstacles are considered during development, this should not have a negative effect on the attitude.

The influence of the perceived ease of use on the perceived usefulness is also recognized during this study, especially concerning the naturalness of the tool. Participants indicated the use of a PHR can be beneficial for work efficiency and help to save time for consultation, but if the application is not intuitive in the use, not matching the current workflow, this will diminish the time gain and therefore affect the perceived usefulness.

In general, the participants in this study expressed more concerns for the ease of use of PHRs than the usefulness. However, they did come up with solutions for their concerns and thought these issues could be resolved but need attention. Therefore, the attitude towards PHRs does not have to be influenced.

7.3 Strengths and limitations of the study

This study provided in-depth insights from GPs with knowledge of patient-centered applications. The participants already experienced some often heard concerns and were able to comment on these. The extended semi-structured interviews gave the participants the ability to develop their thoughts, leading to more elaborate views.

However, this selection might have introduced a bias in the participant group. Therefore, this study could have missed some important perspectives.

Only one nurse practitioner participated in this study. Although this does not provide a insights for this profession in general, the input from this participant was considered interesting, because this was the only participant that already worked with self-measurements from patients. Since providing self-measurements will be an important functionality of PHRs, these insights were considered very valuable.

7.4 Future challenges

For a complete and generalizable result a suggestion would be to extend the sample group and include non-experienced GPs as participants. As well as nurse practitioners, particularly for insights in using PHRs for chronically ill patients. Furthermore, other medical disciplines can be included to assess how data exchange between different medical professionals can be realized.

The patient's perspective is equally important to make PHRs a successful application. Therefore, a study on the perspectives of patients should be done in order to develop a PHR that is useful for both medical professionals and patients.

Integration in information systems comprises many technological challenges. Before development these should be assessed as well. This can be done using the multiple layer model of interoperability (Van Pelt, 2014) and involving suppliers of eHealth technologies and HIS systems in the research.

Finally, effective support during the implementation and adoption phases should be arranged. Further research is needed to establish how this support should be conducted.

7.5 Conclusion

The adoption of PHRs by GPs could be successful, as there is a positive voice towards this application. However, some aspects of PHRs and its implementation require attention. This relates to the structure of information - to overcome the records from being polluted and realize the requested data overviews, standards for data input should be developed in collaboration with GPs. This also applies for monitoring of data input by patients, rules for limit values need to be developed. Also, it should be clear who is responsible for this monitoring and to what extent.

Furthermore, attention should be paid to make the PHRs fit in the work processes of GPs. It seems that PHR adoption requires changes in the work process. If these changes are unavoidable, guidance during the adoption and implementation phase might be necessary.

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Appendix A Inventory of PHR options

Inventory of PHR options		
Category	**Functionality**	**Remarks**
Care planning and scheduling	Individual care plan	Suggested or planned care pathway
	Calendar	Appointments, selecting from proposed timeslots
Consents and authorization	Trusted professional circles: healthcare institutes, specialisms/departments, healthcare professionals	
	Trusted personal: family, friends, legal guardians, volunteers	
	granting / freezing access to healthcare institutes, specialisms/departments, healthcare professionals	
Consultation	Mail (including attachments such as images, documents, audio)	asynchronous, eConsultation with HCPs
	Second opinion	asynchronous, eConsultation with HCPs
	Video consultation	synchronous
Emergency	Emergency information	Emergency call info, direct links to alarm centers, send PS to emergency center.
	Alarm systems	Red button
Financial	Healthcare insurance information	bills, claims, et cetera
Healthcare Institute information (generic)	Information about healthcare institutes and healthcare professionals related to the patient	Location information, opening times, rental of equipment, appointments
	Hospital	Location information, opening times, rental of equipment, appointments
	GP practice	Practice information, opening times, appointments, specific services (wheelchair-friendly access, languages spoken)
	Laboratory	Laboratory results, appointments
	Radiotherapy	schedule, doses, care plan, cosmetics, appointments
	Physiotherapy	Training schemas and videos, appointments

Inventory of PHR options		
Category	**Functionality**	**Remarks**
Healthcare Institute information (patient specific)	Lab results	Import and viewing of structured information from HCPs
	Diagnostic study results	Functional, radiological and chemical study results and reports
	Medical documents and images	Referral- and discharge letters
	Patient summary information	History & physical, medical history, lifestyle & social information, procedures et cetera
Information	General information about lifestyle, health, prevention	Information modules that can be 'switched on' by HCPs in their EHRs
	General information about diseases, disabilities and procedures	Information modules that can be 'switched on' by HCPs in their EHRs
	Disease-oriented communities, patient groups, self-help groups, platforms and fora	
	Communication with trusted circles (family, friends, home assistance	
Measurements	Chemical: blood glucose, O2 saturation, INR, iPill	Structured information that can be shared with HCPs
	Physical: blood pressure, heart rate, body weight, body length, spirometry	Measured values can be sent directly, at intervals or only when they fall out of the preset range. Input through apps, devices, wearables etc.
Medical information	Blood group	
	Allergies	
	Genome information	
	Lab results, medical history, lifestyle information, social	
	Genome information	

Inventory of PHR options		
Category	**Functionality**	**Remarks**
Medication	Current medication	Current medication overview, medication history; prescription, distribution and use
	Administration / consumption	Entering and logging of administered medication
	Repeat medication	
	Side effects / complication notification	Patient experiences with medication
	Alerts for medication use	Apps, dispensers, pill tracers, smart pills, feedback of use to HCPs
	Dosage diaries	Diabetes, INR
Monitoring	Cardiology (Holter)	
	Vital signs (blood pressure, body weight, glucose)	
	Video monitoring	Continuous (sleeping disorders)
	Remote emergency assistance	
Patient Information	Demographic data	
	Advance directives	
	Donor card	
	Insurance information (+links)	
Patient Input	Patient diary	
	Patient questionnaires	
	Screenings	
	Pre-intake screening	
	Pre-operative screening	
	Scientific research participation	
	PROMs, CQIs and PREMs	
Patient profile	Computer literacy assessment	
	Self-care ability assessment	
	Disabilities, handicaps, languages	Needed for better accessibility and understandability

Inventory of PHR options		
Category	**Functionality**	**Remarks**
Requesting	Diagnostic: skin checkup (photographs of suspected skin parts), body checkup	Patients ordering studies
	Therapeutic: corrective procedures (orthodontic, plastic), prostheses; pharmacy delivery	
	Care: home care, meals on wheels, shopping	
	Buying patient care devices and appliances	
	Social: groups, neighborhood activities, etc.	

Appendix B Interview Guide

Algemeen		
	Questions	**Probing questions**
1	Voorstellen	
2	*Systemen professionals* Welk Huisarts Informatie Systeem (HIS) gebruikt u? Welk Keten Informatie Systeem (KIS) gebruikt u? Heeft u een koppeling met Zorgdomein? Heeft u een koppeling met het LSP? Heeft u een regionale koppeling met een regionale samenwerkingsorganisatie (RSO)? Met welke ziekenhuizen werkt u samen? Wat voor koppeling heeft u met andere systemen? - Fysiotherapeuten - Lab - Diëtisten - GGZ - Verpleeghuizen - Thuiszorg - …	Hoe zijn koppelingen georganiseerd? Portaal?
3	*Systemen patienten* In hoeverre heeft u ervaring met het gebruik van zorgondersteunende applicaties/tools? - PGOs - eConsult - Diabetes, COPD, astma, CVRM, Parkinson, … - …	Hoe zijn hiervoor keuzes gemaakt? Waar heeft u zich hierover geïnformeerd? Collega's, leveranciers?

Ervaren relevantie		
	Questions	Probing questions
4	Wat voor associaties/ideeën heeft u bij een PGO?	
5a	Hoe zou een PGO er volgens u uit moeten zien? (functionaliteiten)	Voor welke doeleinden zou u een PGO kunnen gebruiken?
5b	Wat voor informatie zou u van de patiënt willen verkrijgen? a. Voor het consult b. In de wachtkamer c. Tijdens het consult d. Na het consult e. Vervanging van het consult?	Wat voor informatie zou u beter inzicht geven in de medische situatie van de patiënt? Wat voor informatie zou helpen de tijd binnen het consult zo goed mogelijk te benutten? Is de herkomst van de informatie nuttig om te weten?
5c	In hoeverre denkt u dat uw patientpopulatie een PGO zou kunnen gebruiken? - - Kunnen ze inloggen?	Welke patientgroepen/ziektebeelden/topics?
5d	Wat voor informatie zou u de patiënt willen geven buiten het consult?	Hoe zou u deze informatie willen leveren? - Links naar online informatie - Tips voor bijvoorbeeld cursussen - Beantwoorden van vragen
6	In hoeverre ziet u de meerwaarde van een PGO? - Voordelen PGO	Wat denkt u dat een PGO voor u zou kunnen betekenen? - Concrete voorbeelden
7	Wat voor bezwaren ten opzichte van een PGO ervaart u? - Nadelen PGO - Privacy - Overbodige informatie - Kost teveel tijd?	- Concrete voorbeelden
8	Wie mag er nog meer in het PGO schrijven/inzien? - Arts assistenten	

Ervaren gebruiksgemak		
	Questions	Probing questions
9	Op welke momenten heeft u momenteel contact met de patient buiten het consult om? - Lab uitslagen - Ongeruste patienten	Wat voor middelen gebruikt u hierbij?
10	Op welke momenten zou u het PGO kunnen gebruiken? a. Voor het consult b. In de wachtkamer c. Tijdens het consult d. Na het consult e. Vervanging van het consult	
11a	Hoe zou een PGO er volgens u uit moeten zien? (lay-out) - Doctor's view (UI specifiek voor arts)? - Integratie in het HIS -> Hoe?	- Wat wilt u als eerste zien (openingsscherm)? - Wat wilt u nog meer kunnen zien?
11b	Hoe zou informatie verkregen vanuit het PGO moeten worden gevisualiseerd? a. Lab resultaten b. Medicatie gebruik c. Zelfmetingen d. Dagboeken e. Anders?	- De informatie zelf - Waar in het HIS zou dit te zien moeten zijn?
12	Op welke manier zou contact met de patiënt via het PGO volgens u gefaciliteerd moeten worden? - eConsult (via secure mail in de applicatie) - Video conferencing - Anders?	
13	In hoeverre zou u begeleid willen worden bij het gebruik van PGOs? - Technisch, Processmatig - Uitwisselen van ervaringen	
14	Wat maakt een PGO onhandig in het gebruik?	
15	Waar wilt u het PGO kunnen gebruiken? - Op visite (app) - Op vakantie/weekends	

Appendix C Information Letter

Informatiebrief onderzoek integratie van PGO's in de werk- en informatie processen van huisartsen

De Persoonlijke Gezondheidsomgeving (PGO) is een van de oplossingen die wordt aangedragen om de informatiepositie van patiënten te verbeteren. Het is een digitaal hulpmiddel waarmee individuen hun eigen gezondheid gerelateerde informatie kunnen managen. Een PGO geeft bijvoorbeeld inzicht in medische dossiers, maar het geeft ook patiënten de mogelijkheid zelf informatie toe te voegen. Hierbij kunt u denken aan dagboeken en zelfmetingen. De verwachting is dat het aantal mogelijkheden snel zal toenemen. Een aantal voorbeelden:

- Communicatie tussen patiënt en zorgverlener faciliteren: eConsult, email contact
- Monitoren van zelfmetingen (bloedsuikerwaarden, bloeddruk, gewicht)
- Beter zicht op medicatiegebruik
- Verstrekken van informatie aan de patiënt buiten het consult
- Verkrijgen van informatie van de patiënt voor het consult

Hiermee wordt een PGO een levenslang relevant hulpmiddel voor de patiënt. Maar het kan ook een hulpmiddel worden waar u als arts baat bij hebt.

Doel onderzoek

Om optimaal gebruik te kunnen maken van PGO's moet worden bekeken of en hoe de medisch professional het PGO zou kunnen gebruiken. Hiervoor zijn wij geïnteresseerd in het perspectief van medisch professionals die al ervaring hebben of net willen starten met dit soort digitale hulpmiddelen. Wij willen graag van u weten wat uw ideeën en eventuele bezwaren op dit gebied zijn.

Het onderzoek zal bestaan uit een interview dat ongeveer 45 minuten in beslag zal nemen. Wanneer u toestemming geeft wordt het interview opgenomen en verder er zullen notities worden gemaakt. Vanzelfsprekend zullen deze volledig anoniem worden behandeld en worden de opnames en transcripten niet verstrekt aan derden. Indien u nog vragen heeft dan kunt u contact opnemen.

We zouden uw deelname zeer op prijs stellen en zien uit naar uw antwoord.

Met vriendelijke groet,

Marije van der Geest
Email: geest@nictiz.nl
Telnr.: 06-20709606

Appendix D Coding framework

Based on conceptual framework	
Category	**Codes**
Perceived usefulness	▪ Work efficiency ▪ Work productivity ▪ Job relevance
Perceived ease of use:	▪ Availability of support ▪ Consistency ▪ Effective information presentation ▪ Effective use of language ▪ Efficient interactions ▪ Forgiveness and feedback ▪ Minimize cognitive load ▪ Naturalness ▪ Preservation of context ▪ Simplicity

After open coding	
Category	**Codes**
Perceived ease of use:	▪ Structure of information
Before consultation	▪ Information before consultation ▪ Interaction with patient before consultation
During consultation	▪ Information during consultation ▪ Interaction with patient during consultation
After consultation	▪ Information after consultation ▪ Interaction with patient after consultation
Replacement of consultation	▪ PGO as replacement of consultation
Information	▪ Diary ▪ Lab results ▪ Medication ▪ Online information ▪ Questionnaires ▪ Self-measurements ▪ Treatment policy
Interaction with patient	▪ Online appointments ▪ eConsults ▪ Pictures ▪ Provide information ▪ Video conferencing ▪ Patient self-management
Concerns	▪ Concerns about PGO

Appendix E Result tables

Table E1. Different forms of information that can be provided by GPs to the patient were discussed during the interviews.

Providing information to patient		
Medication	Providing a view on medication information	*"They can already see their own medication. I think it is a good feature, it saves me and the assistant a lot of trouble",* (Participant 01, GP)
Lab results	Providing a view on lab results, with comments from healthcare provider	*"A patient should not see any laboratory results without explanation",* (Participant 01, GP)
Treatment policy	A summary of the agreed treatment policy or what was discussed during consultation	*"It would be very helpful if patients could see the agreed policies. […] Especially at the GP center. There you often don't know the patient. They recently have been to their GP […], but when I ask what their GP thought there is no clear answer, then you've got to start all over again […] so you're doing a lot of double work",* (Participant 02, acting GP)
Advice/information	Providing direct (online) information to the patient through the PHR (*Thuisarts*)	*"I want to give reliable medical information and Thuisarts is in my opinion one of the best in this area, with explanations in [simplistic] language",* (Participant 04, GP)

Table E2. Different forms of interaction with patients were discussed during the interviews.

Interaction with patient		
eConsults	Online consults through secure email, can include pictures	*"You should be careful not to chat with patients all day, but I think it's good that if someone has a specific question following a consultation instead of calling the assistant […] If someone just asks a question directly, you can already make a call appointment, or a consultation appointment, or answer directly",* (Participant 02, acting GP)
Provide Advice/information	Providing direct (online) information to the patient through the PHR (Thuisarts)	*"You really need to think about [how concrete you want to provide information]. I think people are happy that we, as doctors, are objective. You don't want to discredit the good name",* (Participant 04, GP)
Video conferencing	Consultation through a video call	*"The simple checks, that can be replaced very easily. If I have video and it's reliable, there are things I can view via video. People already regularly send pictures, for example from the skin",* (Participant 01, GP)
Online appointments	Give patients the ability to plan consultations online	*"I think care can be organized much more efficient, logistically. Like making appointments, that can be very complicated from time to time",* (Participant 04, GP)

Table E3. Different forms of information that can be received from the patient were discussed during the interviews.

Receiving information from patient		
Self-measurements	Measurements (blood pressure, blood sugar, weight etc.) provided by the patient	*"I think that if you have a goal with an activity tracker, agreed with the nurse practitioner for example, you should be able to put that in your file",* (Participant 03, GP).
Diaries	Complaint specific diaries	*"A diary is basically just a kind of test that tries to gather longer term data to make connections. If I would already have it in my system, I can be prepared much better for the conversation with the patient and get to the core of the problem right away",* (Participant 06, GP).
Questionnaires	Complaint specific questionnaires	*"When a patient fills in a questionnaire for the complaint before consultation, you are actually halfway through your consultation at the moment the patient arrives in your office",* (Participant 03, GP).