Analyzing the role of a telemedicine system in health service personalization

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Abstract

In this study, we analyze how a telemedicine system can be used in health service personalization. Telemedicine refers to the use of ICT to deliver health services at a distance. Through a case study, we identify and analyze how a telemedicine system used as a monitoring platform supporting home-based self-measurement of various parameters of Asthma and Diabetes, and measurement of International Normalized Ratio (INR) and Hypertension can support personalization of health service pathways. In our qualitative analysis, we analyzed personalization in the service level and identified three different roles the telemedicine system plays for health service personalization: generating user data, detecting anomalies, and supporting interaction. The results provide insight on the role of information systems in service level personalization.
Keywords: Service personalization, Healthcare, Telemedicine, Information System.

1. Introduction

Along with the rapid advances in information and communication technologies (ICT), the soil for personalization has become increasingly fertile. While having its roots in business, where service providers, such as marketers, have personalized the products and services for the user "by hand" [26], in the contemporary era ICT has taken personalization to the next level [17], [22]. In other words, information systems have made personalization a more varied, but also affordable strategy to implement interactive relationships with users than it was previously possible [24]. Today, traditional face-to-face service encounters are often enhanced by technology [7], and digitalization is integrated across different sectors of our society [28]. Consequently, more and more information about user needs and preferences is available for service providers to perform personalization [21].

One service domain where service personalization is an integral part of service delivery is healthcare [1]. Health services are often delivered in close interaction between patient and healthcare professional, and the services need to address the patient's individual medical needs [4]. Increasingly, these services are supported by information systems that act as an artefact that allow the information to be accessible at the right time, and place for the right person in a right format [29]. Recently, the advances of mobile health, the use of mobile communication devices, such as smartphones, and wireless patient monitoring devices in healthcare, provide novel ways to deliver health services [15]. These technologies have also potential to transform the whole healthcare domain [30]. Delivering health service over distance with the help of ICT is called "telemedicine" [15]. Scholars have proposed that integrating telemedicine technologies to

healthcare may improve the quality of the service, and to make the service more personalized [2], [18].

In this study, we analyze how a telemedicine system, used as a monitoring platform, can support personalization of health service pathways. Care pathways (also known as a clinical pathway or care map) are longitudinal treatment plans that describe all treatment steps to ensure the coordination and continuity of care [9]. In this study, we use the concept of service pathway [19] in relation to describe personalization on a health service level. This differentiates our research focus from personalization research focusing on personalization of the Information System (IS) tool [5] as in the present research, we see IS as personalization enabler towards a personalized service pathway, not as a target of personalization per se.

Previous studies have acknowledged that health services need to be personalized as a premise [1], and that the information systems can enable the delivery of personalized health services [2]. Previous research for personalization has focused on personalization of information system components [5], personalization definitions [23, 24], and personalization in service interaction [25]. However, there is a lack in studies examining the role of information systems in personalization of the service pathway. With the present study, we address this gap and answer to the following research question: How *can a telemedicine system support health service personalization?* To answer to this question, we conducted a case study examining how a telemedicine system, developed by a Finnish IS service provider Elisa Corporation supports health service personalization. Our research contributes to the personalization literature by identifying three roles information systems can play in health service personalization.

2. Related work

This section summarizes relevant research on the use of information systems in healthcare, and how digital technologies support service level personalization.

2.1. Technology-supported health services

Health services are highly complex and expensive services that have a direct impact on individual's quality of life [1], [6]. For the patient, the services are personal, as they are targeted at the patient's body or mind [4]. For the service provider, this requires the constant need to understand the patient from a holistic viewpoint: combination of the medical condition, age, mental condition, personal traits, preferences, family situation, and financial capacity, as all these components influence the service delivered [1].

The delivery of health services is typically done in close interaction between patient and healthcare professional [4]. However, there is an ongoing trend to move towards proactive care and preventive interventions through use of IS [2]. Information systems in service delivery can be a resource enabling the knowledge and skills to be created, shaped, shared, and applied across the actors [29]. One form of this transformation are mobile health solutions that can empower patients by enabling self-measurement, self-monitoring, and self-care at a distance [14]. These technologies enable patients to acquire and transmit information about their health condition in a patient-centric manner, and to communicate with the healthcare professional for better understanding and knowledge about the factors that influence their health condition [8].

The use of information systems in healthcare has potential to improve the outcome of healthcare, while reducing the costs [6]. Personalized healthcare [2], patient-centric care [29], and improved communication between patients and healthcare professionals [18] are factors that can be supported and enabled by the use of information systems and digital technologies. There is some agreement that digital technologies, such as mobile health technologies have potential to fundamentally change the way health services are delivered [30].

2.2. Personalization in technology-supported services

Personalization is an ever-appealing concept that is widely examined in the fields of IS, computer science, and marketing [10], [21]. Service personalization is defined as "any

behaviors occurring in the interaction intended to contribute to the individuation of the customer", and service providers often face the dilemma on how to provide efficient, standardized service at a good enough level of quality, but also treat each customer as a unique individual [25]. In IS research, personalization has been studied from the viewpoint how technology can be personalized [5]. Personalization is often done by the service provider, who uses technology to understand the individual user needs, and to tailor certain service offerings (varying from tangible custom-made products, to intangible, personalized e-mail and search results), to match these individual user needs [26]. Internet is yet the most fertile domain for personalization [17], [24]. However, as services in different domains are becoming increasingly integrated with technology [12], [28], personalization opportunities are arising in all service domains. One domain where personalization is seen as essential, transformative factor is healthcare [13].

Based on our knowledge, current research does not provide us with a model that would focus on health service personalization. However, the technology mediated personalization (TMP) framework [22] provides us with a means to understand service personalization through information technology more generally. TMP consist of three dimensions: (1) interaction personalization, (2) transaction outcome personalization, and (3) continuity personalization. The framework was originally developed to classify service personalization literature for a business context. We use the framework to classify service personalization literature for health service context by providing personalization examples to each dimension.

The first dimension, *interaction personalization*, refers to the personalized interaction between actors. Calling customer by name, or using similar dialects or vocabulary in the interaction are examples on how interaction can be personalized [25]. With the support from IS, the interaction may take form of an e-mail, or chat-services, where the personalized interaction is mediated by technology [7]. In healthcare, personalizing health information to match patient's cognitive style and attitude has been found to improve the interaction between patient and professional while also increasing the understanding of the presented information [11].

The second dimension, *transaction outcome personalization*, refers to customization of products or services, based on user specifications. Choosing a set of components from a pre-set menu is a one example of outcome personalization [4], [25]. Outcome personalization is about options where personalization is done by the user, but is controlled by service provider [3]. In personalization literature, when user is given options to personalize the service, the term customization [17], user-initiated personalization [10], explicit personalization [5], and user-driven personalization [13] are used. A practical example of this type of personalization in healthcare is the situation where a patient may influence, and even choose, healthcare components from the available "service menu" set by the service provider [4].

The third dimension, *continuity personalization*, refers to ongoing personalization based on the user preferences and goals. Continuity personalization is about unique knowledge gained from the user in the service co-creation situations [27] over time. This type of personalization bases on the "deep" knowledge gained from the long-term relationship with an individual user. In health context, professionals, such as therapists may personalize their services to match individual patient preferences in a unique way, evolved over time in the co-creation with the patient [12]. IS may support this type of personalization by providing continuous information about the patient, for example, in a form of daily self-measurement results [14]. Through the digitalization across industries, the increased number of user data provides more possibilities to service providers to perform personalization [21].

3. Research Methods

We approached our research question through a case study. A case study is especially useful in situations, where the goal is to study a contemporary issue in a real world setting [31]. In this section, we present the company, the case (a monitoring platform for home-based self-measurements), as well as data collection and analysis methods.

3.1. Research setting – the company

We conducted a case study with Elisa Appelsiini, a Finnish digital service provider. Elisa Appelsiini is a subsidiary of Finnish telecommunications, ICT and online service provider Elisa Oyj, which serves over 2.3 million consumers, companies and organizations. Elisa Appelsiini focuses on development and provision of ICT services and solutions (sales support, social media marketing, customer service, and information security) including digital healthcare solutions in the form of a monitoring platform that supports home-based self-measurements.

The development team members of the monitoring platform and related IS components have a mix of business and technical competences, but as the company operates in the health domain, external healthcare actors are involved in the development process to provide health knowledge. The internal development team does not include healthcare professionals. Clinical professionals, including people from collaborating medical hardware suppliers are involved as external actors. In addition to these external actors, the company also collects user experiences and feedback from the users of the telemedicine system (both patients and healthcare professionals).

3.2. The case - monitoring platform for home-based self-measurements

Our unit of analysis, the monitoring platform (Figure 1.) is a one form of a telemedicine system, where health services are delivered over distance with support from ICT. The platform was launched in 2014 and it has been available for patients and care providers since. By platform, we mean that the monitoring platform utilizes same scalable technical solutions to enable home-based self-measurements for four different measurement programs: Asthma, Diabetes, INR and Hypertension. By supporting the measurements of various parameters of Asthma and Diabetes, and measurement of INR and Hypertension to monitor conditions where these parameters are relevant, the goal of the monitoring platform is to improve the quality of care, customer experience, and the efficacy of care. With "condition", we mean that INR measurements are not linked to a specific medical condition, but INR value needs to be measured, for example, in the case of atrial fibrillation. In that condition, regular measurements from the patient are required, and with the analyzed monitoring platform, patients can do the measurements remotely, and automatically transmit the measurement results to the healthcare professional to analyze and follow-up.

The service process in the monitoring platform involves two actors, the patient and the healthcare professional. The patient does the self-measurement remotely (regarding to the measurement program set) and transmits the measurement results to the healthcare professional, who monitors and analyzes the care process. Healthcare professional may not be checking the measurement data daily or in real time, but when needed from the care perspective. Technically, the service process includes three service touchpoints. First touchpoint is a measurement device with which the measurements are done. Second is the mobile application, where the measurement results are transmitted via Bluetooth technology. These are the service touchpoints for the patient. The measurement results are further automatically transmitted to healthcare professionals' web-application, which is a service touchpoint for the healthcare professional. These service touchpoints are used as contact points between the patient and the healthcare professional, as illustrated with a Diabetes measurement example in Figure 1.

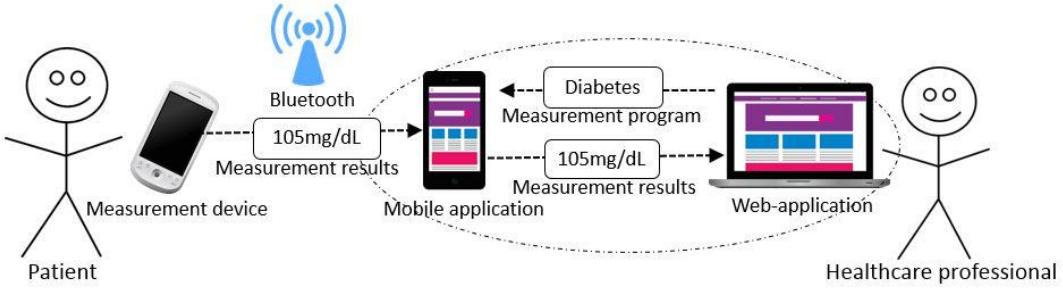

Fig. 1. The monitoring platform for home-based self-measurements

In practice, if the patient is diagnosed with diabetes, the healthcare professional creates the diabetes measurement program for the patient using the web-application. The diabetes measurement program is then transmitted to the patient's mobile application. The patient can download the mobile application from an application store (iOS or Android). The mobile application is connected to a medically classified measurement device (for example GlucoTel in the case Diabetes) with a Bluetooth technology. The patient can choose the information channel of the measurement by choosing the operating system (between iOS and Android) and the measurement device (must be medically classified and support Bluetooth technology) from several available options. Once configured, the patient does the diabetes measurement based on the measurement program the healthcare professional has set.

3.3. Data collection and analysis

Data collection and analysis occurred iteratively throughout the research process using a qualitative data analysis approach [16]. First, we discussed the outline of the study with the case company representatives. Two scholars participated in the meeting with four company representatives, and as a result, we narrowed the scope of the research to the monitoring platform that supports home-based self-measurements. We signed a non-disclosure agreement and received seven documents (total 218 pages, both English and Finnish) regarding to the monitoring platform. The documentation was analyzed to get an understanding of the role of the monitoring platform in service personalization, and design decisions leading to personalization related implementation choices. The analyzed documents included descriptions of the monitoring platform architecture and implementation, guidance to use the monitoring platform (for both the patient and the healthcare professional), and user experiences and evaluation of the use of the monitoring platform (collected from both patients and healthcare professionals). In the document analysis, one author first read all the documents. After familiarization, the documents that described the monitoring platform and the four measurement programs were re-read for understanding the functionality of the monitoring platform and the differences between these four measurement programs. In order to understand the role of the monitoring platform for health service personalization, the document analysis was complemented with a focus group interview with the core development team. The members in the core development team were considered to be the key informants for this case [31]. Combining the document analysis and focus group interview enabled us also to have multiple sources of evidence, which is important in case studies [31].

The focus group was done with three key informants from the development team: a director of health services, a business manager, and a service designer. In the focus group, we discussed the following themes regarding to personalization: developers' general knowledge and viewpoints for personalization, personalization techniques used in the monitoring platform, the boundaries and limitations for personalization, and the trade-offs and value personalization provided in this case. The focus group was done with an open-ended nature and the aim was that the key informants being experts could express their viewpoints, and provide additional thoughts beyond the themes.

The focus group was done in Finnish, lasted for 80-minutes and was audio-recorded and transcribed immediately afterwards. As a result, all the forthcoming quotes used in this paper are our translations. In our inductive analysis [20], one of the authors transcribed the interview and carried out the initial analysis and familiarization with the data. The aim was to understand and identify the decision making process behind personalization through a thematic analysis. Themes were identified through recognizing elements the designers and developers used for describing decisions they made regarding service personalization. The three personalization dimensions of TMP framework were all covered, i.e. the goal was to look for design aspects related to include or exclude personalization features of all aspects of service personalization. In the next step, there were extensive discussions about initial findings and thematic categories describing the design decisions with other authors. Based on the discussions, we concluded

with three main categories, which are presented in the section 4. After the focus group, our findings were discussed and evaluated by the key informants. We sent the document that included our preliminary findings and had two Skype meetings with a key informant who had participated to the focus group. In these Skype meetings, the key informant validated our findings and provided more information to complement the preliminary findings.

4. Findings

In this section, we present the result of our thematic analysis process, which is the three main categories for designing service level personalization. These categories are: generating user data, detecting anomalies and supporting interaction. We illustrate these three roles in the Figure 2, using fixed hypertension measurement results as an example. Hypertension refers to a condition where blood pressure is measured to be consistently high. The blood pressure device typically displays the systolic pressure, diastolic pressure and pulse in addition to the time and date information. With the mobile application, patients are able to provide additional information to provide context for the measurement result.

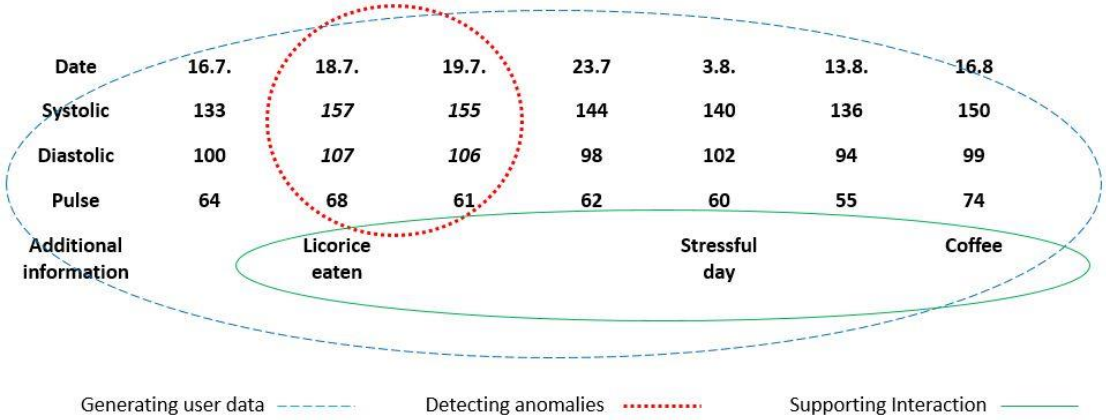

Fig. 2. Three different roles the monitoring platform plays for service personalization

First, the monitoring platform was an enabler for self-measurements and a solution to generate data in the conditions (long dash blue line), where the continuous measurements are necessary from a care perspective and are included to support treatment of the conditions for which hypertension measurements are necessary. Second, along with the data generation, the monitoring platform enabled the detection of anomalies (measurement values displayed in italics and the line indicated with the red dots) in the state where self-measurements were not done successfully, or the measurement results were outside boundary values. Third, the monitoring platform provided support for interaction (solid green line) between the patient and the healthcare professional, allowing the patient to reflect and provide context to support the measurement results and help the healthcare professional interpret the measurement results. In the following sections, we describe these three roles in detail.

4.1. Generating user data

The monitoring platform generated raw data that can be used for health service personalization either by healthcare professionals manually, or by generating personalization support for decision making on how to proceed with personalization. Creating raw measurement data through self-measurements was defined to be the most important functionality of the system, as described by an informant:

"With this system, we create automatic, real-time user data for healthcare professional to analyze" (Director of health services).

The decision to use self-measurement in care is done in collaborative decision making through a discussion between patient and healthcare professional. The goal is to generate data, which serves the care process only. The measurement program should not generate data which does not have direct use in care. If a patient is diagnosed for diabetes, the measurement program for diabetes is set, and the system generates data that is relevant to diabetes care pathway and the actors involved in the diabetes care only, as highlighted in the following quote:

"The data collected has to be relevant for the user, but also for the professional, the data is transmitted. So it adds value to the care procedure" (Director of health services).

"In this case, personalization means relevant information and nothing else. For both the patient and the healthcare professional" (Director of health services).

In order to keep the measurement process reliable and manageable for healthcare professional, patients were not able to provide any data beyond the measurement program. Patients could do extra measurements regarding to the measurement program set, but not for other purposes (such as for personal interests), as the heterogeneity in data would make the data analysis for healthcare professional more complex:

"If the system would be 100% personalized, the patient would be able to decide what data to send and when. For the healthcare professional, the data would be more heterogeneous, and complex to analyze" (Director of health services).

The above quote interestingly shows that the service provider considers personalization as full freedom for the patient to choose how to behave during care, which hardly is the aim of any healthcare service.

Data generation is the most important functionality of the telemedicine system. Patients can do the measurements at a distance and as the measurement results are automatically transmitted to healthcare professional to monitor and follow up, the data is increasingly generated. The data generated can be used to support the decision making in personalization, and with the data, a more comprehensive picture of the patient can be drawn for service personalization.

4.2. Detecting anomalies

The raw data generated can be used to detect anomalies, which can be helpful in making personalization decisions. The telemedicine system uses a traffic light technique (red, yellow, green) to display the patient status to the healthcare professional. The traffic light is available for healthcare professional through the web-application, which is used to follow up the patients' measurement results. The traffic light is a visualization that helps detecting anomalies quickly, as described by an informant in the following quote:

"With the traffic lights, the healthcare professional can easily see the patient's status. That reduces the workload of healthcare professional, but also enables the rapid reaction for anomalies in measurement results." (Director of health services).

The traffic light visualization helps the healthcare professional to have an overview of the status of the patient and to see whether the measurements are done properly, and in time. For three measurement programs (Hypertension, Asthma, and Diabetes), traffic lights follow the same parameters that indicate the patient status in the self-measurement program. Red traffic lights are used if more than 24 hours have passed since the last measurement. Yellow indicates that 12-24 hours have passed since the last measurement. Once a measurement is done in time (less than 12 hours), the status is displayed in green. Grey indicates that the measurement program has not started, or is finished, and therefore data about measurements is not available. For the fourth measurement program, INR, the traffic light technique is utilized with different parameters as red indicates that the measurement result is outside boundary values. Yellow

either indicates that the measurement is more than 48 hours late, and that the previous measurement result is beyond the normal limits, or that measurement is more than one week late and the previous result being in the normal limits. Green indicates that measurement is done in time and the result is within the normal limits, and grey that measurement is either finished or has not yet started.

For the health service, the healthcare professional can then detect the anomalies in the data and personalize the treatment to the individual patient based on the measurement data. This provides benefits as healthcare professional can react rapidly to measurements that are missing, failed, or are beyond the normal limits, as otherwise detecting and reacting may take a longer time, as descried in the following:

"Based on the data from the system, healthcare professionals can react to these (abnormal values and failures in measurements) rapidly. Previously it may have taken for a week before the patient comes to see the healthcare professional and tells that s/he has not been doing measurements for a week, because the device had crashed" (Business manager).

By detecting anomalies, healthcare professional can react to abnormal and missing measurement results, and be active in proposing alternative care pathways or options, which would better fit the needs of the patients. This is illustrated by the following quote:

"*It personalizes the process, because now (based on the anomalies detected) the healthcare professional can notify patient that the self-measurement is not working properly and therefore adjust the measurement, or the dosage of an individual patient*" (Business manager).

The healthcare professional can personalize the health services based on the anomalies detected. The traffic lights display the patient status, and as potential problems occur, the healthcare professionals can provide personalized interventions, for example, by changing the dosage or providing other supportive services for the individual patient based on the measurement data.

4.3. Supporting interaction

For interaction, the self-measurement service uses either one-way or two-way interaction in the measurement programs. One-way interaction means that the patient can send personalized comments to healthcare professionals. Two-way interaction allows the healthcare professional to reply to the message the patient has sent. Currently, one-way interaction from the patient to healthcare professional is available for all measurement programs. Patients can provide additional information to healthcare professionals to support the measurement results and to give some context to the results that helps the healthcare professional to interpret the results, as illustrated in the following:

"The commenting is one-way as patient can provide comments in addition to the measurement result" (Business manager).

In INR, the system allows two-way interaction in the form of notifications from healthcare professionals to patients. The patient can provide context for the measurement, and if the healthcare professional decides to change the dosage, a notification is automatically send to the patient. In the focus group, it was pointed out that the aim is to enhance the level of interaction, meaning that both patient and healthcare professional can comment on the measurement results. As a result, the interaction regarding health services can be more collaborative, as the example below illustrates:

"In INR, you may provide optional comments to your measurement results, such as that the abnormality in INR value may be because of the red wine [you drank]. Based on these comments, the healthcare professional may provide comments back [to the patient], to have one glass less next time." (Business manager).

Two-way interaction will be implemented also to other measurement programs in the future in the form it is necessary from the health service perspective:

"*That means, in Asthma, the two-way interaction may be beneficial, but in hypertension for example, the need may not be that urgent (from care perspective).*" (Business manager).

The idea in the interaction from the health service point of view is that as the measurements are done at distance, the comments that the patient can send to the healthcare professional along with the measurement results provide context for the healthcare professional. This allows the healthcare professional to interpret and follow up on the measurement result and to provide feedback and supportive services relevant for the individual patient. The patient also can trust that the professional is always involved and part of the service process:

"The healthcare professional gets a richer picture about the patient (when the patient adds comments) even though the patient would not be physically present. The patient on the other hand can be sure that there is always a professional checking the results and comments" (Business manager).

Even if the interaction would be one-way only, i.e. from patient to healthcare professional but not the other way round, the possibility to provide comments in real-time to the healthcare professional is beneficial when compared to the situation where the comments are provided at the premises of healthcare professional, for example, weeks after the actual measurement. In two-way interaction, the patient receives automatic notifications (in INR) when the healthcare professional changes the dosage, but in the future the aim is to personalize the service process more. One of the future plans is to use measurement data for pro-active actions, such as identifying when the patient will run out of the measurement strips, and creating personalized interaction for supplying the strips:

"*One component in INR measurement are INR strips. If the patient runs out of strips, the measurement cannot be done. Process-wise, these issues could be discussed in the preventive manner in the interaction*" (Service Designer).

The idea in the interaction is that the patient provides context for the self-measurement, that (s)he receives notifications when the INR dosage is changed, and that some parts of the service can be adjusted in the interaction between actors.

5. Discussion

Integration of information systems and digital technologies into healthcare has potential to make the health services more personalized for the individual patient [2], [18]. One form of an information system that is utilized in healthcare is telemedicine that refers to the use of ICT to communicate, and to deliver health services to remote locations [15]. Telemedicine enables healthcare professionals to provide health services at a distance [30], and it can also improve the level of communication between the patient and the healthcare professional [18].

In the present study, we examined the role of information systems in personalization of the service pathway. Through a case study, we analyzed how a telemedicine system, used as a monitoring platform can support service level personalization. We identified and illustrated three roles, 1) generating user data, 2) detecting anomalies, and 3) supporting interaction, the information system plays for health service personalization.

Generating user data for service personalization. The monitoring platform generated data for health service personalization in continuous manner once the self-measurements are done. Data generation, creating raw measurement data through self-measurements is the most important functionality of the telemedicine system according to the service provider. The data generated through measurements should serve the care process only. Prolonged data generated

from a single patient can be used to form a more comprehensive picture for service personalization. Generating user data for service personalization is aligned with the prior personalization literature as technology can provide more and more data about users to service providers to be used for personalization [17], [21], [26]. Data generation is a continuous process where services are continuously adjusted to match the individual user needs, referred as continuity personalization in the technology-mediated personalization (TMP) framework [22].

Detecting anomalies for service personalization. The monitoring platform generated raw measurement data that can be used to detect anomalies. Detecting anomalies can support the personalization decisions, as the telemedicine system informs healthcare professional once the measurement is failed, done improperly, or when the measurement result is beyond the normal limits and needs a personalized intervention, for example, in the form of changing the dosage or providing other supportive services based on the anomalies in the measurement data. Detecting anomalies is also a continuous process [22], and from personalization perspective, healthcare professional monitors the self-measurement data, and personalizes services based on the data gathered, these referring to transaction outcome personalization and continuity personalization in TMP [22]. User data forms the base for service providers to perform personalization [17], [26]. In the case of anomaly detection, the purpose of personalization is to use the understanding of normal status of the patient to tackle situations where the patient faces technical problems in measuring, or when the measurement results are beyond normal limits.

Supporting interaction for service personalization. Telemedicine system is found to improve the level of communication between the patient and the healthcare professional [18]. Here, patients were able to provide additional information for the healthcare professional to support the measurement results and to give context to the results. The additional information may help healthcare professional to interpret the results. In the future, healthcare professional may be able to react to the cases where patient, for example, commented about running out of INR strips. Patients were able to provide context for their measurements using their own dialects and vocabulary (service interaction personalization [25]). For healthcare professional, the interaction is limited to automatic notifications when changing the dosage. Therefore, service interaction personalization (dialects, vocabulary) did not occur from healthcare professional side that comprehensively. According to the service provider, there are plans to enhance the interaction aspect from the healthcare professional side, for example, in the form of adjusting the service components (transaction outcome personalization in TMP [22]), such as providing extra INR strips or other services for the patient. With the enhanced two-way communication, there are potential to make the service more personalized, for example, by supporting the individual patient in the daily life decision-making [8].

The three dimensions: generating user data, detecting anomalies and supporting interaction provide insights on the support a telemedicine system plays for health service personalization. In health services, personalization is a premise [1], and IS literature also acknowledges personalization to be a transformative factor in health services [13]. Information systems can act as an artefact, supporting the patient and healthcare professional in the health service delivery [29], and scholars have also proposed that IS can be used to personalize health services [2]. In the present study, we illustrate through a case study how a telemedicine system can support health service personalization. Both, telemedicine as a technology and personalization as a concept has been studied already extensively, but the role of technology in service personalization is a field lacking conceptual and theoretical research. Telemedicine provides novel possibilities to deliver health services [15], [30] and technology is a primary enabler for personalization [17], [24]. Here, our focus was on the service level personalization, where information system acted as an enabler towards a personalized service pathway. As services today are increasingly integrated to technology [12], [28] we suggest that there are novel possibilities to design personalization, and that the findings of this paper provide insights on the design of personalization for technology-supported services.

There are limitations in this study. Here we report a single case study that focused on one telemedicine system that acts as a monitoring platform in the Finnish health context. Our focus was on the service provider’s viewpoint. The patient and healthcare professional viewpoints

were excluded from this study. Data collection was limited to a small number of key informants that may have narrowed the findings. However, even the numbers were limited, we believe the key respondents we able to represent the company's viewpoint. In the future studies, the aim is to investigate the patients' viewpoint for health service personalization.

6. Conclusion

In health context, service personalization is integral part of the service delivery. Health services are increasingly integrated to information systems and digital technologies that provide novel opportunities to deliver services, personalized for the individual patient needs. This paper reports a case study, with an aim to identify and analyze how a telemedicine system, used as a monitoring platform supports personalization of health service pathways. By analyzing personalization on the service level, we identified three different roles the telemedicine system plays for health service personalization. The three roles: generating user data, detecting anomalies, and supporting interaction provide insights on the support information systems can provide for service level personalization.

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