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ABSTRACT

The healthcare sector has done significant investments in technology in order to improve their processes; however there is evidence showing that new technology is not optimally used in certain healthcare settings. In this paper we present a framework to analyse how digital self-service (DSS) can optimize processes and improve patient experience in a polyclinic context. The framework consists of five digital self-service types and seven patient's experience factors, both taken from literature and validated for experts. The framework aims to show the influence of DSS in patient's experience. The results show a positive impact of self-service diagnosis, treatment and monitoring on the patient`s experience, as well as the positive impact of all the DSS in the patient`s experience factor "Information". The framework also provides new ideas for further research. In general, this framework can be used by polyclinics and other healthcare institutions to 1) investigate possibilities to optimize processes and 2) identify, which DSS have positive impact on patient's experience.

INTRODUCTION

Global healthcare spending, including investments in technology aimed at decreasing cost, improving efficiency and increasing patients satisfaction, has been increasing in previous decades and likely will increase in the future. However, case studies show that processes using new technology are not optimal in certain healthcare settings.

The two primary domains leveraged in this study are Business Process Management (BPM) and Digital Self-service. BPM is emerging as an important management practice to help organizations to improve its processes (deBruin, 2007). Digital Self-service has been widely used to increase client experience and satisfaction. According to Meuter et al. (2000), Self-Service Technologies are increasingly changing the way customers interact with firms to create

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service outcomes. Thus, the practical motivation of this study is to improve processes in, in our case, a polyclinical setting in order to improve patient`s satisfaction using self-service technologies.

In the past, research has been done on patient satisfaction in a healthcare setting (cf. Doyle et al., 2013; Rozenblum et al, 2013; Murti et al., 2013). Also, research has been done on BPM and digital self-services (cf. Manfreda, 2012; Khodambashi, 2013; Gupta et al., 2010). However, to our knowledge very little research has combined these topics. The main focus of research on digital technologies in health care settings appears to be point-of-care or health delivery systems (Atkinson et al., 2004; Nahm & Poston, 2000). Little research has been done on self-service systems in healthcare and its implication for business processes. We will combine knowledge of BPM and self-service technology and apply the result to the healthcare situation, specifically polyclinics. Furthermore, the current research on the effect of health systems on patient satisfaction seems to be primarily correlated with patient characteristics (Bleich et al., 2009) instead of on patient-system interaction. We aim to improve the current knowledge in this respect.

The context of this study is the healthcare sector, specifically a polyclinic that has several bottlenecks in its processes and, as consequence, lower patient satisfaction. Taking this context into account, the purpose of this study is create an IT-framework to optimize processes in a polyclinic context using digital self-service technology and analysed how DSS can improve patient experience.

Therefore, we pose the following research question:

> ***How can digitized self-service improve a patient's experience in polyclinical visits in terms of lead-time, patient's safety and less patient complaints, from a process improvement perspective and taking into account healthcare regulations?***

This paper takes a design science perspective in creating a solution for the research question (Hevner et al., 2004), as it is our aim to construct a usable solution that is relevant for practice, as well as rigorously designed. The research is based on an explorative case study as well. Following Hevner et al. (2004) our methodology consists of literature review and explorative case study, which results in a framework . The framework is then validated by experts from an academic institute and a healthcare consultancy firm. Based on expert feedback, the framework was improved. During this process, healthcare regulations are taken into account and improving patient experience will be the main aim.

The paper is divided into several sections. In section 2, we present the theories that support our research and develop the framework. In sub-section 2.2, we describe an explorative case study and how our initial constructs from literature can be further worked out in our framework in specially a polyclinical situation. As a result, our detailed framework has practical experiences. In section 3, we describe the validation of the framework and consequently improve the framework, based on expert reviews. Finally, in section 4, we discuss the results, conclusions and further opportunities for research.

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PATIENT EXPERIENCE AND DIGITIZED SELF-SERVICE

Literature review

In order to explore existing theories and relevant research, which supports the theme of this study, we defined a search strategy. The main data sources were Google Scholar and Science Direct. Based on the constructs in the research question, the following keywords were selected: patient`s experience, patient satisfaction, digital self-service, business process improvement and healthcare regulations, healthcare standards, we also searched for papers identifying the polyclinic visit process. These keywords were selected due to their importance to the theme of study and they will aid to answer the research question.

The primary purpose of the literature review was to define the factors that influence the patient experience, with focus on which factors improve patient`s satisfaction. Second, taking into account BPM theories, we searched in the literature for the different types of Digital Self-Services that have been used to improve healthcare processes and patient experience. Finally, healthcare regulation was considered as the context that influences the adoption and the use of technology in healthcare settings.

Patient experience

Scientific literature on patient experience supplies a large number of factors that are assumed to correlate with patient experience in healthcare such as clinical quality, communication with doctors, cleanliness of the rooms, etc. Yet, e.g. Manary et al. (2013) state that patient satisfaction is not universally defined. They state that most researchers use different sets of measures. Also e.g. Espinal et al. (2014) confirm this statement in their conclusions.

We note that the two following terms are commonly used interchangeably: patient experience and patient satisfaction. We will define the terms as follows. Patient experience is all experiences a patient has during any interaction with the healthcare organisation. Patient satisfaction is the mental result the patient experiences during and after the interaction. Patient satisfaction is then the construct that can be measured with questionnaires or other instruments that measure cognitive states. Murti et al. (2013, pp. 36-37) give a similar definition of the more general term customer satisfaction. They define customer satisfaction as the assessment by the customer of the provided service and his/her emotion-based reaction. If the service provokes positive feelings, then customer satisfaction is high. If it provokes negative feelings, then satisfaction is lower.

Llanwarne et al. (2013) focus on the most obvious factor in patient satisfaction: clinical quality. Interestingly, they found that the correlation between clinical quality and patient experience (i.e. patient satisfaction) is low. However, Manary et al. (2013) do suggest, in contrast with Llanwarne et al., that "even a controversial measure such as "satisfaction" appears to be tied both theoretically and empirically to quality".

Manary et al. (2013) cite Boulding (2011) and Glickman (2010) by stating that "patient-reported measures not only are strongly correlated with better outcomes but also largely capture patient evaluation of care-focused communication with nurses and physicians, rather than non care aspects of patient experience, such as room features and meals". This implies that these last

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aspects do not influence satisfaction to a measurable degree, but interpersonal relationships between patients and care providers and the outcomes of healthcare do.

Rozenblum et al. (2013) performed a literature review in search of the influence of Health Information Technologies on patient satisfaction. They found that the correlations between the usage of Health Information Technologies and patient satisfaction is not consistent.

We sorted the different findings from the literature study, which are related to patient satisfaction, into categories. This was done based on their common characteristics as mentioned in the literature. See Table 1 where the references are mentioned in the last column. For example, Llanwarne et al. (2013) explicitly mentions care quality and lists the factors. We added other references in the categories when there is overlap in either the category name or in the sub-factors.

The categories are:

- Care quality
  Consists of the quality of the care delivered to the patient, includes both objectively measured outcomes and perceived outcomes.

- Interpersonal relations and communication
  Consists of communication and relations between the care providers (doctors, nurses, etc.) and the patient and the manner in which these are conducted.

- Logistic processes
  The supporting logistic processes, such as appointment planning, discharge planning, and continuity.

- Information
  The manner and extent the patient receives information about the diagnosis, tests, treatment and other processes.

- Facilities
  The quality of the facilities, such as rooms, equipment and surroundings.

- Inter-organisational relations.
  The quality of relations between organisations involved with the patient, such as between the GP and a polyclinic.

- Patient and support network involvement
  The quality and manner of involving the patient and his/her support network in the care process.

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Table 1: Patient experience factors.

Category	Factor	Reference
Care quality	Access to healthcare resources	Llanwarne et al., 2013; Jha, 2008 in Manary, 2013
	Clinical adherence to treatment guidelines	Doyle et al., 2013
	Clinical effectiveness, technical quality-of-care delivery	
	Adherence to recommended medication and treatment	
	Self-rated health outcomes, objectively measured health outcomes, adverse events; patient safety	Llanwarne et al., 2013;Boulding et al. in Manary et al., 2013
	Care planning	
	Pain management	Doyle et al., 2013
	Preventative care	
Interpersonal relations and communication	Clear information, two-way communication, emotional and psychological support, respect and understanding for beliefs, values, concerns, preferences and understanding of patient condition, transparency, honesty, disclosure when something goes wrong,	Doyle et al., 2013
	confidence and trust in doctor	Llanwarne et al., 2013; Manolitzas et al., 2014
	Communication and interaction with doctor and other care providers (e.g. courtesy, friendliness, dignity, empathic, respect, compassion and professional attitude)	Boulding et al. in Manary, 2013; Robinson et al., 2013; Parasuraman, 1988 in Manary et al., 2013; Bleich et al., 2009
Logistic Processes (see also Manolitzas et al., 2014)	Waiting time for treatment and diagnosis, length of stay	Chakraborty et al., 2014
	Waiting times	Bleich et al., 2009
	Timeliness of assistance	Boulding et al. in Manary et al., 2013
	Discharge planning	Boulding et al. in Manary, 2013;
	Continuity of care professional (e.g. see preferred doctor instead of available doctor)	Llanwarne et al., 2013; Espinel, 2014
	Facile/efficient care processes	
Information	Medical informatics	Rozenblum et al., 2013
	Explanation of medications administered	

	Education/information giving	Boulding et al. in Manary et al., 2013 Espinel, 2014
Facilities	Cleanliness of room and bathroom, noise level at night quality of basic amenities hospital environment Attention to physical support needs and environmental needs (eg, clean, safe, comfortable environment) Wayfinding	Boulding et al. in Manary et al., 2013 Bleich et al., 2009 Robinson et al., 2013 Doyle et al., 2013 Salamati & Zbigniew, 2014
Interorganisational relations	Care coordination Responsiveness of health system Coordination and continuity of care; smooth transitions from one setting to another	Manary et al., 2013 Bleich et al., 2009 Doyle et al., 2013
Patient and support network involvement	Patient engagement Cultural differences Patient ownership of clinical decisions Involvement in care decisions Involvement of, and support for family and carers in decisions	Manary et al., 2013 Murti, 2013 Doyle et al., 2013

Digital Self-Service

From literature, the digital self-services types were divided into several categories (see Table 2). The process was less straightforward than for the patient experience factors. We first listed all different examples of digital self-service from the literature and then tried to determine the goal of each example. This could be mapped relatively easily into five distinct self-service types:

- Data access is related to how the patient can access the data, for example, by phone, interactive kiosks or online tools.
- Identification is related to the patient identification.
- Self-service diagnosis and diagnosis information is related to giving the patient the tools and knowledge to perform certain diagnoses themselves while the care provider facilitates the process.
- Self-service treatments and treatment information is related to giving the patient the tools and knowledge to perform certain treatments themselves. This is already common with, for example, diabetes and most medication.

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- Self-service monitoring and monitoring information is related to giving the patient the tools and knowledge to perform certain health monitoring activities themselves. For example this is common for diabetes patients.

Table 2: Self-service categories.

Categories	Digital self-service types/typologies	Reference
Data access	Interactive kiosks	Meuter et al., 2000; Gupta et al., 2010
	Online websites and -applications	Meuter et al., 2000
	Healthcare networks Telephone, interactive voice response, Telemedicine Video and video-conferencing	Salamati & Zbigniew, 2014
	Personal Health Records Digital customers service (FAQ, order tracking, bill tracking, delivery tracking)	Meuter et al., 2000; Gupta et al., 2010; Salamati & Zbigniew, 2014
	Counseling preceded by use of a computer-based decision aid	Meuter et al., 2000; Tuil, 2007 in Rozenblum, 2013
	Software consisting of web-based electronic medical records, an education guide and a messaging system enabling electronic communication between the patient and staff	Green 2005 in Rozenblum et al., 2013
	Automated test result notification system to patient	Ross, 2004 in Rozenblum et al., 2013 Matheny, 2007 in Rozenblum et al., 2013
Identification	Biometric identification	Gupta et al., 2010; Salamati & Zbigniew, 2014
Self-service diagnosis and diagnosis information	Data integration to detect anomalies, correlations, patterns	Gupta et al., 2010
	Decision aid designed to help patients choose among currently recommended colorectal cancer screening programs.	Dolan, 2002 in Rozenblum et al., 2013
Self-service treatments and treatment information	Personalized medicine Personal treatments, medication ordering Computer-assisted diabetes care intervention.	Salamati & Zbigniew, 2014
	An interactive videodisc designed to assist	Williams, 2007 in

	patients in the decision-making process involving treatment choices for ischemic heart disease. Computer-based decision aid with standard genetic counseling for educating women about BRCA1 and BRCA2 genetic testing Interactive computerized delivery methods providing information about long-term hormone replacement therapy Computerized decision support (DSS) for oral anticoagulation monitoring	Rozemblum, 2013 Morgan, 2000 in Rozenblum et al., 2013 Green, 2004 in Rozenblum et al., 2013 Rostom, 2002 in Rozenblum et al., 2013 Fitzmaurice, 1996 in Rozenblum et al., 2013
Self-service monitoring and monitoring information	Quantified self/self-monitoring Smart gadgets (smart watches, wrist band sensors, monitoring patches, smart phones, brain-computer interface, neuro sensing, emotional mapping, home automation sensors and environment monitoring sensors)	Salamati & Zbigniew, 2014

The specific process of polyclinical visits can be divided in a number of steps. From literature (Oh & Chow, 2011; Kidak & Aksarayli, 2011; Rohleder, Lewkonia, Bischak, Duffy & Hendijani, 2011) we identified the following polyclinical process steps:

1. Referral
2. Plan appointment
3. Check-in / registration in polyclinic
4. Preparation for the consultation/appointment/treatment
5. The actual consultation/appointment/treatment
6. Follow-up determination
7. Check-out from polyclinic

In the explorative case study, the steps in the polyclinic process were further fine-tuned. This is elaborated in section 2.2 where we will also map the process steps to these digitized self-service types.

Regulation

This study considered the regulations that influence the adoption of technology in healthcare, primarily digital self-services technologies. There are several studies that discuss this subject and the main concern is related to security and privacy of patient's information (Hiller et al., 2011; Kluge, 2006). This is because the protection of the privacy and security of health data is essential for any Electronic Health System to reach its full potential (Hiller et al., 2011).

According to Article 29 Data Protection Working Party (2007), another reason for the focus on privacy is because all data contained in medical documentation, in electronic health records (EHR) and in EHR systems, should be considered as sensitive data. Therefore, security and privacy are important points because healthcare institutions are responsible for correct patient's information.

The Article 29 Report points out eleven areas that should be part of the data protection framework for electronic health records. Summarizing, these areas discuss a special protection for sensitive personal data; a general prohibition of the processing of personal data concerning health, with derogations; a necessity of explicit consent from the patient to use his data; Data security, such as the prevention of unauthorized access and the development of a reliable and effective system of electronic identification and authentication.

EXPLORATIVE CASE STUDY

We used the results of a consultancy project by Engage (http://www.engage-software.com) on the process improvement of a polyclinic (in this case a cardiology polyclinic) as a basis for our case study. The project is highly applicable for us due to three factors. First, the polyclinical process of a cardiologic polyclinic is straightforward, as it does not have many variations. Second, a polyclinical healthcare setting requires efficient and effective coordination between several skilled professionals. Therefore Business Process Management methods and techniques can be used to model this coordination and suggest improvements. Finally, as a consequence from the previous two factors, polyclinical processes in general follow a similar pattern, which makes this study generalizable to other polyclinical situations.

Based on the literature study and our case study, we propose the following generic polyclinic visit process:

1) Referral
   The patient requires a referral from a GP or other licensed care provider, before visiting the polyclinic. The referral can be delivered to the polyclinic through integrated systems, telephone, fax or letters. This step is linked to the following digitized self-service types: data access, identification.

2) Plan appointment
   In non-emergency cases, an appointment is required. The appointment needs to be accepted by both the patient and the polyclinic. In certain cases, the appointment can be modified or cancelled. This step is linked to the following digitized self-service types: data access, identification.

3) Check-in / registration in polyclinic
   When the patient arrives at the polyclinic, then he/she needs to register with reception in order to avoid waiting for patients that do not show up and to start preparing the consultation.

4) Preparation for the consultation/appointment/treatment
   Prior to the actual consultation, certain employees of the polyclinic may need to prepare the consultation by checking the completeness of patient files, making last minute changes to the planning, and fixing any problems that may crop up. This step is linked to the following digitized self-service types: data access, identification.

5) The actual consultation/appointment/treatment
   From the perspective of the patient and care provider, this is the most important process. The patient is present in the waiting room and is called for the consultation. The care provider talks with the patient and performs tests, makes a diagnosis or prescribes a treatment. This step is linked to the following digitized self-service types: data access, identification, self-service treatments, self-service diagnosis.

6) Follow-up determination
   After the consultation, the care provider determines the next steps. A patient may need additional treatments or tests, either on the same or on a later day. The patient may need to plan another appointment or remain in the polyclinic. This step is linked to the following digitized self-service types: data access, self-service treatment, self-service monitoring.

7) Check-out from polyclinic
   The last step is that the patient leaves the polyclinic. The care providers need to collect all relevant information into the dossier of the patient. This step is linked to the following digitized self-service types: data access, identification.

The focus of our paper is on the polyclinical processes from a BPM perspective, which means that improving the *primary* healthcare processes themselves, such as diagnosis and treatment, is not considered. Only 'secondary' healthcare processes in the polyclinic are taken into account.

Based on the case study, several bottlenecks can be identified. We will give a short overview here and we will elaborate on them later in this article. One of the most important bottlenecks can be summarized as a lack of ownership of processes. This is related to unclear processes which are not performed in a timely manner and do not take the patients perspective into account. There are several examples of this in our case study. For example, when the patient is referred to the polyclinic, a triage must be performed by a cardiologist to determine the priority. If this triage is not completed because the cardiologist is absent or too busy, then the patient cannot make the appointment and must call several times to get information and schedule a definite appointment. Another example can be found in the planning process itself. It is a common occurrence that patients need to undergo some sort of test, like an ECG, and then discuss the results with the cardiologist. However, these appointments are not planned together. This means that there will be several days between the test and the consultation. On the other hand, patients that need biyearly check-ups, cannot schedule their appointment after the consultation, because the scheduling horizon is only 4 months.

Furthermore, the way of working can be classified as 'fragmental', which leads to either double work or important actions that are not performed. One example is found in the activities that are performed by the receptionist (front-office). The receptionist not only welcomes patients, but

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also performs activities that are part of the back-office. Also, employees tend to check continuously, instead of at the appropriate time.

Finally, patients are informed in an unclear, error-prone or late manner. When a patient wants to book an appointment, it may actually be impossible to do so due to problems with internal processes. Also, patients are not informed about waiting times. Appointment confirmation takes place through the phone and thus relies on the ability of the patient to remember the precise appointment time and date

A FRAMEWORK FOR THE EFFECT OF DIGITIZED SELF-SERVICE ON PATIENT EXPERIENCE

Given the tables in the previous two paragraphs, we created a framework. The framework consists of a mapping between the different digital self-service types and the factors that constitute patient experience. We analysed the literature to find whether using a certain type of self-service technology has a positive, negative or no effect on a certain factor in patient satisfaction.

The table can be read in the following way. A type of digital self-service may have an effect on the identified factors about patient experience. For each combination, the references to specific paragraphs in specific articles are given, including the effect found in that article. The paragraph number is preceded by a §. If the effect is positive, then a plus-sign (+) is given. If the effect is negative, then a minus-sign (-) is given. If no effect is found, then an equals-sign (=) is given. An empty cell implies that we could not find a combination in the literature. In section 3, we rely on expert opinion to fill the empty cells.

Table 4: Outline of the framework, which shows how and to which degree digital self-service improves aspects of the patient experience.

Digital self-services types / Patient`s experience	**Data access**	**Identifi-cation**	**Self-service diagnosis and diagnosis information**	**Self-service treatments and treatment information**	**Self-service monitoring and monitoring information**
Unspecified	+ Rozenblum et al., 2013 Matheny, 2007 in *Rozenblum et al., 2013 et al* = Tuil, 2007 in Rozenblum		- Green, 2004 in Rozenblum et al., 2013	+ Rostom, 2002 in Rozenblum et al.,2013	+ Fitzmaurice, 1996 in Rozenblum et al., 2013

	et al., 2013 et al				
Care quality	+ Gupta et al.: §3, = Salamati & Zbigniew: §1 - Rozen-blum et al., 2013 §1	+ Gupta et al.: §1.2.4, §3 - Gupta et al.: §2.1	+ Salamati & Zbigniew: §3.2	+ Salamati & Zbigniew: §3.2	+ Salamati & Zbigniew: §1
Interpersonal relations and commu-nication	= Ross, 2014 in Rozenblum et al., 2013				+ Salamati & Zbigniew: §1
Logistic Processes	+ Gupta et al.: §3, + Salamati & Zbigniew: §1	+ Gupta et al.: §1.2.4, §3			
Information	+ Whelan, 2003 in Rozenblum et al., 2013l		+Salamati & Zbigniew: §3.3		+Salamati & Zbigniew:§3.3
Facilities	+ Salamati & Zbigniew: §1	+ Gupta et al.: §2.2			
Interorgani-sational relations		+ Gupta et al.: §1.2.4			
Patient and support network involvement			+ Salamati & Zbigniew: §3.1	+ Salamati & Zbigniew: §3.1 = Morgan, 2000 in Rozenblum, 2013	+ Salamati & Zbigniew: §3.1

In general, some areas will see improvement while others will not. In most cases, no information can be found in the literature, which is the cause of some empty cells. It can be seen that the effect of digital self-service on care quality is better researched than the other category, leaving room for further research. Also, it can be seen that digital access of patients to their data is wider researched than the other digital self-service categories.

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SITUATIONAL VARIABLES AFFECTING THE FRAMEWORK

The framework as defined in the previous section consists of five digital self-services mapped onto seven different factors making up patient experience. The different types of digital self-services have different requirements, such as situational constraints, standards, regulation and patient characteristics, which determine their applicability in a given context.
We focus on the guidelines provided by the Article 29 Working Group (2007) and the impact of these guidelines on the different self-service types. The table below gives an overview of these guidelines per self-service. There is one overarching category 'General', which captures the guidelines that are applicable to all digital self-services. We added references to other articles we found.

Table 5: An overview of guidelines published by the Article 29 Working Group concerning processing of personal data in EHR's.

Digital self-service	Requirements and constraints
General	The system must be designed to be secure (e.g. Salamati & Zbigniew, 2014) Information inside the systems, especially data about patients, needs to conform to the relevant privacy legislation and, if possible, use privacy enhancing technologies (Article 29 Working Party, 2007)
Data access	Guidelines concerning the international transfer of medical records (Article 29 Working Party, 2007) Guidelines surrounding authorization for accessing to EHR (Article 29 Working Party, 2007)
Identification	Regulation surrounding identification methods (Article 29 Working Party, 2007)
Self-service diagnosis and diagnosis information	Guidance surrounding the use of EHR for other purposes with the exception for medical scientific research and certain governmental purposes (Article 29 Working Party, 2007)
Self-service treatment and treatment information	No specific guidelines found
Self-service monitoring and monitoring information	Guidance surrounding the use of EHR for other purposes with the exception for medical scientific research and certain governmental purposes (Article 29 Working Party, 2007)

In the Netherlands, the law is even more strict. The Law concerning Personal Information states in section 13 that '[t]he responsible party will provide fitting technical and organisational measures to secure personal data against loss or any kind of unlawful processing. These measures guarantee, taking into account the current state of technology and the costs of

implementation, a fitting security level taking into account the risks that processing and the nature of the to be secured data necessitate. The measures are aimed at preventing unnecessary collection and processing of personal data.

Another area of interest for digital self-service is standards. Standards describe, usually on a technical level, how systems can exchange data between themselves in a standard way. However, there are many standards involved in the healthcare domain. For example, the Dutch Institute for IT in healthcare (Nictiz) has an overview of standards on https://www.nictiz.nl/page/Standaarden/Overzicht-standaarden. These are only the standards that are directly applicable in the healthcare domain in the Netherlands. So, it is important to take standards into account, but evaluating the applicability of standards to each of the self-service types is out-of-scope for this paper.

There are other areas that need to be taken into account, because each area will supply different constraints on the self-service types. The research are called 'the social shaping of technology' (Williams & Edge, 1996) defines areas such as:

- sociological, which gives constraints about the acceptance by society of the implementation of self-service technology,
- legislative, which constrains the way certain information is stored, processed and shown to stakeholders,
- (business) economical, which places constraints on the investments in, costs of and profits from self-service technology,
- organisational, which places constraints on the acceptance of self-service technology in the organisation it is implemented,
- engineering, which places constraints due to technical requirements,
- personal (both patients and care providers), both from a psychological and a physical standpoint, which place constraints about usability, effectiveness and efficiency on self-service technology.

It can be argued that each of these areas is worthy of several papers at least. More research is needed on this field, for now we briefly list a number of our findings.

Because of the advance of digital self-services technology, several studies have been performed with the purpose to analyse the factors that affect the use of these technologies from customer's perspective. Most of these studies are performed in the financial industry. Still we reason that these are applicable for this study due to the focus on the use of self-services technology from customer`s perception.

Hacine et al (2012) investigate the different factors affecting customer's intention to use a digital self-service tool in the bank industry. The dimensions considered by Hacine (2012) are "perceived usefulness", which means the benefits to customers such as time and cost saving and provision of more services; "perceived ease of use", which means that the tool must be easy to learn and easy to use in order to prevent the under-use system problem; "perceived self-efficacy" is defined as the judgment of one's ability to use the tool, in other words, the confirmation of the critical role of knowledge, skill and familiarity play when using digital self-services tools and

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"perceived trust", which is defined as a user's confident belief in a honesty of the institution toward the user.

Davis (1989) also focused his research on perceived usefulness and perceived ease of us. The purpose of his research was to find the fundamental determinants of user acceptance of computers and pursue better measures for predicting and explaining use. The main result of Davis's investigation was that the usefulness had a significantly greater correlation with usage behaviour than did ease of use.

Meuter et al. (2000) discuss factors as motivation and knowledge as factors that influence the use of self-service technology by customers. Research on customer participation suggests that role clarity, motivation and customer ability are important factors affecting customer participation in service delivery (Bowen 1986; Schneider & Bowen, 1995; Meuter et al., 2000). Rieder and Voß (2010) pointed out the influence of age in the usage of self-services technology. The author performed a research about the impact of these technologies in seniors' life. The result demonstrated that self-service technology represent an important role in seniors life. The use of automated machinery was quite common in the research sample and e-services usage is a little less frequent.

AN EXPLORATIVE VALIDATION OF THE FRAMEWORK

In the previous sections, we elaborated on the IT framework based on the research question and the literature review. However, this framework is still only based on literature and needs validation. According to Hevner et al. (2004), a framework can be evaluated in terms of functionality, accuracy, completeness, usability and other quality attributes. We used a qualitative technique to validate the framework. The validation was made through interviews with two experts from an academic institution. In addition to their PhD degrees, both experts have other knowledge and practice that made them good candidates to perform the validation. One expert works as healthcare IT consultant and the other one has long experience in organizational processes, also in healthcare. We interviewed these experts because they have a broader view on the situation than, for example, employees of a polyclinic and have more experience in different settings.

The interview was divided into open and close questions (the questionnaire is available upon request to the authors). The questions were formulated specifically with the aim to validate the framework in terms of utility, quality, and efficacy. We especially focused on the completeness, accuracy and fit with the organisation of the framework.

First of all, we asked the experts to review the research question and rate the relevance for polyclinics. This question validated the fit of the research and the framework. The experts thought that the research question will lead to new insights and actionable advice for polyclinics and as such has a good fit with the organisation.

The questions were also intended to validate the digital self-service types and patient experience factors, which were found in the literature review, as well as the correlations between them. Therefore, the questionnaire contained two open questions with focus on digital self-services typology and another two with focus on patient's experience factors. Furthermore, a closed

question relating DSS types with patient experience was included. First, we asked the experts which factors they considered to make up patient experience and we asked them to analyse the patient's experience factors found in the literature. We repeated this process for DSS types. This confirmed the completeness of the framework.

To validate the relation among DSS types and patient experience, we asked the experts to fill a matrix relating these variables in the same way as our original framework was constructed. This validated the accuracy of the framework. The results are discussed below. Both experts agreed with the DSS typologies and the patient experience factors selected in the literature review. Thereby, we did not exclude any DSS typology neither any patient experience factor. However, the experts made several remarks in order to improve the framework. Experts doubted whether the factors *inter-organisational relations* and *information* played any role in determining patient satisfaction. However, we think this may have been caused by the fact that we did not offer a complete definition of these terms beforehand. After we explained these items, it became clear that they do affect patient satisfaction, but both experts contended that this only happens in certain situations, especially when problems occur. An example is that patient satisfaction is negatively affected when the transfer of data between healthcare organisations fails.

One expert made an important remark in this context: the factors can be separated into hygienic factors and distinguishing factors. Hygienic factors can be defined as factors that have a certain baseline which needs to be met and will not influence satisfaction when it is increased even more. Only when this kind of factor does not reach this baseline, then patient satisfaction is negatively affected. In contrast, improving distinguishing factors will result in improved patient satisfaction.

This expert also suggested that only the self-service types dealing with diagnosis, treatment and monitoring are distinguishing factors. The other factors, data access and identification, are hygiene factors.

We have summarized the artefact and the expert opinions in an improved framework. It shows the effect of digitized self-service on patient satisfaction. If the effect is negative, a minus-sign (-) is shown. If the effect is neutral or there is no effect, an equals-sign is shown (=). If the effect is positive, then a plus-sign is shown (+). If the effect is strongly positive, a double plus-sign is shown (++). When there is disagreement between the three sources, all variations are shown.

Table 6: Revised framework combining the results of literature and expert opinion on the impact of digitized self-service on patient experience.

Digital self-services types / Patient`s experience	**Data access**	**Identifi-cation**	**Self-service diagnosis and diagnosis information**	**Self-service treatments and treatment information**	**Self-service monitoring and monitoring information**
Care quality	-/=/+	=/+	+	+	+/++

Interpersonal relations and communication	=/+	=/+	=/+	-/=/+	=/+
Logistic Processes	+	=/+	+	+	+
Information	+	+	+	+	+
Facilities	=	=	=	=	=
Inter-organisa-tional relations	=/+	=/+	=	=/+	=/+
Patient and support network involvement	+	=/+	+/++	+/++	+/++

Some interesting areas are those that show disagreement. These are the effect of data access on the patients' experience of care quality and the effect of self-service treatments and information on interpersonal relations and communication. We can speculate on the reasons behind this. For example, one expert reasoned that the effect of self-service treatments on interpersonal relations is negative, because there will be less interaction with the care provider. The other expert reasoned that the resulting interactions will be better, because the patient will be more involved in his own treatment which will also improve the relation with the care provider. The literature suggests that there will be no effect. The disagreement in the other area (data access and care quality) is due to the literature, where examples are given of positive and negative effects. The experts state that the effect is either neutral or positive.

The areas where the effect of self-service on patient satisfaction is very positive have to do with self-service treatment, diagnosis and monitoring. Investing in these areas may yield the most improvements for a polyclinic, because it will positively influence patient satisfaction with patient involvement and support network involvement.

Another interesting point is that experts think that none of the self-service types will have an effect of the patient satisfaction with the *facilities*. From a purely logical perspective, this makes sense. Giving a patient access to digitized self-service will not radically change the facilities, such as rooms, waiting areas and other amenities. Therefore, there will also be no change in the patient's satisfaction with this factor.

Finally, there is agreement that all digitized self-service types positively influence the factor *information*. The reasoning behind this is that it is better for a patient to be more informed about diagnoses, treatments and monitoring and that the patient will be more satisfied when they can access more information. However, one expert mentioned that this can also be negative when the ability of patients to find more information leads to uncertainty and confusion, because they may not be able to evaluate this information properly. We think that it will be important to find a proper balance in this respect.

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The experts also mentioned several situational factors that may influence the relation between digital self-service and patient satisfaction. One expert mentioned one factor is the setting in which the self-service is used, either in the polyclinic or in a private setting. One expert mentioned that the characteristics of the patient might influence this relation too. He states that highly educated patients have a different approach and attitude in seeking and receiving healthcare. However, we did not include these factors in our framework.

CONCLUSION AND FURTHER RESEARCH

This study aimed to develop a framework to optimize processes in a polyclinic context using digital self-service technology. Thus, our purpose was to provide the answer to the following question: "how can digitized self-service improve a patient's experience in polyclinical visits in terms of lead-time, patient's safety and less patient complaints, taking a business process improvement perspective and taking into account healthcare regulations?"

As the primary result of this research we highlight the positive impact of self-service diagnosis, treatment and monitoring on the patients' experience on average. These three types of DSS presented a positive impact in five patients' experience factors: Care quality, Logistic Processes, Information, Patient and Support Network Involvement. Another important result was the concordance between the literature and the experts about the positive impact of all the DSS on the patient`s experience factor "Information". The literature and the experts also point out that the factor Facilities is not influenced by any DSS.

The regulation and standards relating with the DSS usage in healthcare were also considered in trying to contextualize the framework. Most regulation is concerned with the security and privacy of the patient`s data. The main reason for this is because patient`s information demands higher confidentiality. Aspects as motivation, age, digital knowledge, trust on DSS and perceived usefulness were considered also as factors that impact the use of DSS by customers.

Regarding the limitation of this research, we can point out the limited literature available about DSS technologies in healthcare sector and their impact on patient`s experience. Also the framework validation was limited due to the fact that interviews were performed with only two experts. To improve the results of the research it is advised to interview a larger number of experts. Another limitation is that we just analysed one case (one polyclinic). Therefore, analysing other case studies is recommended in order to verify the research results.
For further research we suggest investigating the influence of the DSS type "data access" in the patient`s experience factor "care quality". In a similar way, the impact of the DSS type "self-service treatments and treatment information" in the patient's experience factor "interpersonal relations and communication" is also a suggestion for further investigations.

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