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Patient Portals in German Hospitals – Status Quo and Quo Vadis

Plattfaut, R.; Coners, A.; Becker, J.; Vollenberg, C.; Koch, J.;
Godefroid, M.; Halbach-Türscherl, D.

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Authors

Ralf Plattfaut, André Coners, Jörg Becker, Carolin Vollenberg, Julian Koch, Marie Godefroid, David Halbach-Türscherl

Abstract

The health care sector in Germany has become increasingly important in the scientific field of information systems over the last decades. This development has been reinforced by the demographic change and, more recently, by the current Covid-19 pandemic. Irrespective of the field of work and application, digital interface processes, data acquisition, data exchange, as well as data preparation, analysis, and correct archiving are undoubtedly gaining in importance. They also enable new possibilities for service design and the corresponding provision of both digitized supply services and digitized information services. Against the background of increasing and more complex requirements in the health care system, digitalization can become a very important factor in the provision of services. This is especially true for hospitals. In hospitals, increasing data volume and level of detail increases the complexity of data documentation. Hospital staff currently spend a lot of time on data acquisition and transfer, and correspondingly less time is available for the beneficial core work with patients. Therefore, digitization and automation strategies through patient-oriented interactions are becoming increasingly necessary. Patient portals are one possible way to enable care and new services and to reduce the effort for comprehensive data collection. This paper presents the current situation in Germany regarding patient-oriented solutions by capturing, structuring, and analyzing the market of existing patient portals in German hospitals. Existing portal functionalities are identified and patient portals are evaluated against these functionalities. Our results show that there are only two patient portal solutions in the largest hospitals in Germany and that the existing portal solutions by far do not completely fulfill all functional categories. Based on these results, we develop and discuss further research questions for future research. This includes especially design-oriented research with regards to the digital patient journey.

Keywords

Patient Portal, Portal, Portal function, Healthcare, Patient interaction, Digitalization, Patient Interface, Documentation effort

1 Introduction

Healthcare is one of the most important sectors of the German economy. In the past years, its volume has steadily increased: In 2018, total spending in the German healthcare sector was increased to 11.7 percentage of the GDP (Statistisches Bundesamt Destatis, 2020c). The healthcare sector employs 5.7 million people in all the different functions from hospital staff to medical laboratories (Statistisches Bundesamt Destatis, 2020a). But also in the field of information systems, this topic has experienced a broad and complex spread in the last ten years (Romanow *et al.*, 2012). In many cases, research in our field has created the scientific basis for the exchange of medical data of patients by means of modern information and communication technologies. This is not only the case between doctors and patients but also between individual service providers, and has provided far-reaching insights into new digital diagnosis and treatment options such as personalized medicine, e.g. through apps or the Internet (Berg, 2001; Kohli and Tan, 2016).

Despite its importance for the German economy and a great need for future-oriented approaches, the German healthcare system is lagging behind in terms of digitalization. This is especially true for hospitals (Klauber *et al.*, 2019). Taking the example of administrative hospital processes, currently care staff in hospitals spend about 36 percent of their time on bureaucratic and administrative activities. Especially the data input and output take a lot of time, e.g., in connection with patient-related and administrative documentation obligations. More drastically, German hospital physicians spend as much as 44 percent of their time on documentation and bureaucratic tasks (Deutsches Ärzteblatt, 2015).

As this time cannot be spent on patient care, it has also significant financial implications: The documentation costs amount to approximately 21 percent of the total personnel expenses of doctors and nurses (HIMMS Europe, 2015). In a time of rising economic pressures, this can be critical for hospitals (Köbberling, 2017). Figure 1 below illustrates the large amount of time per day in hours required to complete the documentation work. Working hours spend on documentation are shown across different personnel work groups in a hospital. A chief physician for example spends more than five hours per day for administrative documentation work (HIMMS Europe, 2015).

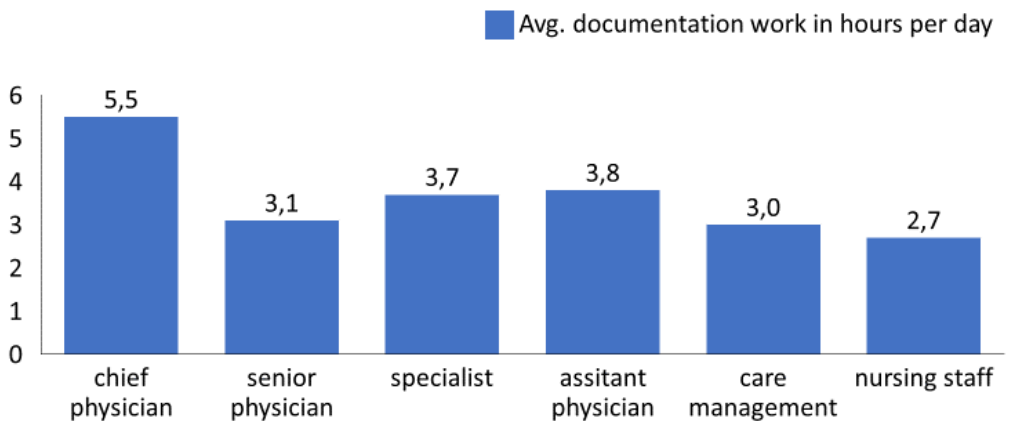

Figure 1: Average hours spend on documentation per day by groups of personnel (HIMMS Europe, 2015)

The documentation effort is not only high, but also rising: Doctors and nurses feel that the documentation effort has increased over the last 10 years - due to the level of detail and volume of documentation required (HIMMS Europe, 2015). And on top of that, a comparison between the estimated time by the staff with calculated time for each documentation task shows that the documentation time is underestimated by the staff (HIMMS Europe, 2015).

Investments in promoting digitalization are intended to ease the workload on nursing staff (Bundesregierung, 2018). However, this has not been successful yet, as the high documentation effort in hospitals could possibly be reduced by digital documentation and interactions with a patient-oriented solution. At this point a patient portal could be one possible solution. The documentation can be done from both sides – the patient and the service provider e.g. hospitals – in this way an interface for exchange is created. The time required for documentation could be reduced by actively involving the patient in the documentation process. Moreover, the processing of the digital data will be made possible.

Recent developments in digitalization are mainly driven by consumers (e-health) (Hordern *et al.*, 2011). Consumers now expect from their healthcare providers easy access to their data and innovative and digital services. Here, patient portals could be a possible solution, too. Using these portals, healthcare providers can offer self-services to the patient which, in turn, allow further digitalization of later internal processes.

So far there is hardly any research in how far hospital staff in Germany already rely on patient-oriented digital documentation and how many hospitals already have a patient-oriented solution in place. A review by Scheplitz et al. (2018) focused on which electronic healthcare portals are currently available on the market, what functions these existing portals offer to the patient, and how one can systematize them. An up to date overview of what is actually in use is however crucial both to practitioners, researchers, and politicians: Best practice examples from other hospitals can help practitioners to improve their operations and thereby improve the overall capacity of the German healthcare sector. An overview would help research to identify avenues for further studies, and link this to other emergent digitalization research from similar sectors, which could help to transfer lessons learned. Finally, sound and detailed insights on the status of digitalization give politicians the basis on which to create laws and initiatives that really help those responsible in the healthcare sector.

Therefore, with this research we want to assess the current state of patient-oriented digital solutions in German hospitals. Specifically, we want to answer the following research question: What functionality is currently offered in patient portals in German hospitals both with regards to patient interaction and backoffice automation?

The remainder of this working paper is structured as follows. In the next section we present related work on customer and patient portals as well as on process automation. Then, we show our methodology. Section four contains the results. We close with concluding remarks where we discuss our results and present a call for further research on patient portals.

2 Related Work

Customer Portals. Customer and supplier portals mainly address external stakeholders. Customer portals allow the customer to get access to company data and information. From the companies' perspective, customer portals primarily support sales. Furthermore, a supplier portal can increase communication between the company and its suppliers (Gentsch and Lee, 2004).

Portals integrate all important systems, processes and data using a uniform user interface. The user can enter and evaluate data or initiate processes. Via personalizable user roles, only the relevant data is transmitted to the user, which gives the user the possibility to cover all his information requirements. In addition to these information functions, portals are also used for communication by offering the user the possibility of exchange and interaction with other portal users (Strohmeier, 2008). By using a portal solution, the data and documents will be digitized – so this digitized data could be used for further digitized processes such as processing with RPA.

Patient portals. Patient portals have existed since the 1990s and were introduced by individual health organizations (Halamka *et al.*, 2008; Mandl *et al.*, 2007). From 2006 onwards, these were driven by specific data exchange programs, including those driven by Google and Microsoft. The introduction of ePHRs (electronic Patient Health Records) plays a central role here. ePHRs have been introduced by the Blue Shield Association and America's Health Insurance Plans, among others (Weitzman *et al.*, 2009). Adoption of patient portals is increasingly driven by the shift in society towards the acceptance of social media and the associated movement towards the acceptance of the daily use of powerful smartphones. One international example for patient portals is MyChart which is used by many hospitals in the American region and was a pioneer in this area (Irizarry *et al.*, 2015).

In the narrower context of healthcare, patient portals include applications that enable patients to access health information via a browser or a specific mobile app. Possible access objects include smartphones, desktop computers, or notebooks (Kildea *et al.*, 2019). The information stored on a server is documented and managed by the respective health care institution. The portals are usually owned by the institution and run web-based. Patients can gain access to a wide range of clinical data and use additional functions designed to simplify processes. For example, the entire appointment allocation process can be run via such a portal (Bourgeois *et al.*, 2009).

The literature reports on several functionalities of patient portals. In the first phase of our research described below, we will identify and cluster these functionalities.

3 Methodology

To answer our research question, we follow a three-stepped research approach. First, we review existing literature to identify publications on patient portals and corresponding use cases. Secondly, we complement the resulting list of use cases with an open web search for healthcare portals (irrespective of geography and provider). Lastly, we conduct a structured internet research on patient portals in the 20 largest German hospitals and five largest hospital groups to assess the current state of hospital patient portals in Germany (see Figure 2).

Figure 2: Research Approach

In our first step, we searched selected journal databases, IS journals, and IS conferences for keywords such as "Patientenportal", "National Patientenportal", "Gesundheitsportal", “Portal Kliniken”, “Klinikportal” and English synonyms. We were, however, not able to identify any survey or analysis of existing patient portal solutions in the German hospitals has been conducted. Nevertheless, a functional analysis of existing national as well as international healthcare portal solutions from the year 2018 by Scheplitz et. al. could be identified with the help of the performed research. Scheplitz et al. (2018) list existing healthcare portal solutions of the national and international market. They used qualitative content analysis according to Mayring (Mayring, 2010) to collect and structure data on existing patient portal functions in categories. Based on these results, they derived eight categories (see results below).

In our second step, we identified different portal solutions using search queries via Google search engine using the same search terms as above. The respective portal solutions were each considered web-based. These portal solutions were not restricted or prioritized according to specific criteria, but were evaluated based on the search results. In some cases, a login to the respective portal followed in order to view and analyze the given functions in more detail. The portals were first not prioritized according to medical practices or hospitals, but also represented health portals (e.g. blood pressure data, diabetics portal).

Lastly, to analyse the national market of patient portals in German hospitals we prioritized the twenty largest hospitals and five largest hospital groups in Germany. The prioritization and ranking of the twenty largest hospitals was based on the number of beds, revenues and the assessment of the hospital's quality (praktischArzt, 2020; BibliomedManager, 2019; a&w Online, 2019). In addition, the five largest private and non-profit hospital groups from a published ranking of the top twenty hospital groups in Germany were analyzed. This selection was based on a ranking of the twenty largest groups in Germany according to the number of inpatient cases in 2012 (Statista Research Department, 2015).

The prioritized hospitals and hospital groups were reviewed for existing patient portal solutions by desktop research on the websites of each hospital or hospital group. At first the website of the respective hospital or hospital group was identified by using the Google search engine. The website of the corresponding hospital or hospital group was actively visited. If a portal for patients to register could not be found, the respective hospital including the term "Patientenportal" was searched with the help of Google search engine again. If a patient portal for one of the twenty hospitals or one of the five hospital groups existed, the respective existing functions were examined according to the eight function categories.

In this way, the patient portals of hospitals and hospital groups in Germany could be analyzed according to the functional categories and technical features identified through step one and two. This allowed to quantitatively assess the existing market of patient portal solutions as well as its dissemination level in German hospitals.

4 Results

4.1 Identification of Functional Categories

Through our literature review (see above) and the analysis of existing portal solutions, eight categories with the respective associated functions were formed. From a literature perspective, we mainly relied on the functional categories identified by Scheplitz et. al. (2018). These were also identified and supplemented with our qualitative research of portal websites in this work. We formed and prioritized our own eight functional categories with the focus on the patient-interaction in German hospitals and used those for our further analysis.

The following Table 1 lists our functional categories A to H and the corresponding name of each category in the first column. The column “Scheplitz et. al. (2018)” represents the corresponding category or categories by the functional analysis of Scheplitz et. al. (2018) to our categories. In some cases, we renamed categories, summarized categories to one, or and added some functionalities. This is explained exemplary in the last column of the table. The column “Explanation and delimitation” gives a short overview of explanations for our functional category in comparison to Scheplitz et. al. (2018). Each category is described in more details below.

Category/Our approach		**Scheplitz et al. (2018)**	**Explanation and delimitation**
A	Digital contact options	Communication	Important function for patient-interaction - Scheplitz et. al. (2018) category “Communication” renamed and added by functionalities e.g. video calls
B	Manage treatments (outpatient/inpatient)	Therapy/Anamneses/ Documentation	Shows the whole history of treatments with corresponding dates, facilities and treatment plans – includes functionalities of Scheplitz et. al. (2018) categories “Therapy, Anamneses, Documentation” like self-tests or checklists
C	Manage documents	Documentation	Documents from the service provider (e.g. hospital) - Scheplitz et. al. (2018) did not differ “Documentation” by service provider and patient in two categories
D	Forms online	Documentation	Documents uploaded or filled out by the patient - Scheplitz et. al. (2018) did not differ “Documentation” by service provider and patient in two categories
E	Manage remedy	Manage remedy	
F	Manage appointments	Administration	Important function for patient-interaction and digitalization of administrative processes - Scheplitz et. al. (2018) category “Administration” renamed

G	Non-personalized health information	Non-personalized health information	
H	Self-Determination	Self-Determination	

Table 1: Evaluated functional categories of patient portals

The "Category A – Digital contact options" offers the patient the possibility to communicate with a doctor or with another patient. E-mails offer the easiest digital contact possibility here. Many of the e-mail inquiries can be automatically answered and immediately intercepted by chat offers. Category A also includes video consultation hours through which the patient can contact a doctor or specialist digitally face-to-face in order to conduct initial discussions or consultations. Forums can be divided into patient forums, where people with similar medical histories or complaints can exchange information, and expert forums, where problems can be shared publicly and discussed with specialists. Another contact option is the evaluation of results, which allows the patient to upload results to the portal and receive feedback and explanations from experts (Scheplitz *et al.*, 2018).

The functional "Category B – Manage treatment" contains the representation of the entire progress of treatments, e.g. for an inpatient stay. At this point, details about performed examinations including time stamps and facilities are documented and accessible for the patient. In addition, treatment plans can be viewed by the patient or individual checklists can be provided before a treatment. The category also covers partly automated recommendations for actions, for example exercises or tutorials for specific symptoms. Besides that the patients can do self-tests as an anamnesis to discover the further steps of their treatment (Scheplitz *et al.*, 2018). But also, non-patient-specific information such as doctor searches are available in this case.

In addition, some of the analyzed portals offer the possibility of document management (“Category C – Manage documents”). This category includes the supply of all documents from the service provider (e.g. medical practice or hospital). Various documents can be made available in the portal by the service provider. This can include physician's letters, diagnostic findings, laboratory results, test results, medication plans, summaries of medical discussions, medical images, epicrisises or surgery reports (Scheplitz *et al.*, 2018). In some portals, allergy overviews or allergy passports, certificates or invoices can also be viewed.

Online forms are another feature of some portals reviewed in the analysis. This functionality primarily describes the management of personal vital data as well as patient complaint reports. There is also the possibility for the patient to upload documents independently in some portals. Using this function, forms or questionnaires are filled out online by the patient and made available to the service provider. The forms can be submitted to the medical practices for example before a planned treatment or appointment The category D (“Category D – Forms online”) includes forms like anamnesis forms, patient questionnaires or information sheets (Scheplitz *et al.*, 2018).

The functional category E (“Category E – Manage remedy”) describes the management of remedies. This category includes several functions according to the remedies a patient needs - prescriptions, follow-up prescriptions, dispatch of medicines and medical devices as well as the subject-related prescription of medication by the doctor. Some portals offer the possibility to make prescriptions available via the portal (Scheplitz *et al.*, 2018).

An international portal even communicates in this way with the responsible pharmacies. Thus, the data is transmitted directly to the preferred pharmacy of the patient so that the patient can either pick up his or her medication on site or have it delivered (Cleveland Clinic, 2020).

Some portals also offer the function of appointment management ("Category F – Manage appointments"). This allows to facilitate administrative appointment management via the patient portal. Appointments can be planned, rearranged or cancelled individually. In addition, some portals also offer appointment reminders for the patient. The administrative interface between patient and hospital or medical practice is also presented in this way (Scheplitz *et al.*, 2018).

Besides personalized information, some portal solutions also provide general health information ("Category G – Non-personalized health information"). This functional category includes encyclopedias, glosses, certain graphics and journalistic articles. But also download areas with information material such as flyers are provided. Furthermore, general advice on inpatient hospitalizations can also be provided. This category also provides the calculation of various health values such as the BMI by using the entered personalized health data or specific information. In some portals, specific information on upcoming treatments for an individual patient can also be accessed (Scheplitz *et al.*, 2018).

To ensure the data security of personal health information, individual portal solutions allow patients to determine their own access rights to files, documents or general data. The "Category H – Self-determination" describes this possibility. The identification of the patient via the patient's own identity card or insurance card allows to ensure the security of the patient's own data. In addition, some portals give patients the opportunity to obtain a different opinion of a second doctor based on the existing data stored in the portal (Scheplitz *et al.*, 2018).

4.2 Status Quo of German Hospitals' Patient Portals

The eight categories summarized the identified functions from different portal solutions. They were used to evaluate and quantify the existing patient portal solutions in German hospitals. The categories were used to assess the hospitals as well as the identified relevant groups.

Table 2 gives an overview of our results on the current state of implemented patient-hospital interfaces in the form of patient portals in Germany. The results are separated between the hospitals and hospital groups. The first row "patient portal" describes the share of hospitals or hospital groups that offer a patient portal. The second row of the table "No patient portal" shows the share of hospitals that do not have any patient interacted portal solutions.

Five percent of the analyzed hospitals offer a patient portal. That means that only one out of twenty hospitals in Germany offers a patient portal. 75 percent of the hospitals in Germany do not show any activities regarding the patient-hospital-interface like a patient portal.

Furthermore, only one of the analyzed five hospital groups offers a patient portal – 80 percent of the analyzed hospital groups in Germany do not offer a patient portal. Table 2 points out that most of the hospitals as well as hospital groups in Germany do not offer a solution for patient interaction and communication by offering a patient portal.

	Hospitals	Hospital groups
Patient portal	5 %	20 %
No patient portal	95 %	80 %

Table 2: Share of hospitals and hospital groups with existing patient portals

To have a closer look on the offered functionalities in the existing portals the following tables (Table 3 and Table 4) give an overview of our functional analysis results of the twenty hospitals and five hospital groups in Germany. As we found only one hospital and one hospital group with existing patient portal solutions, there is no empirical base to evaluate the functions in detail.

Table 3 represents the main result of our analysis of the hospitals. The first column represents the twenty analyzed hospitals. The following columns represent our eight evaluated functional categories A to H. The first nineteen hospitals listed do not offer a patient portal. It is obvious that the hospitals without a patient portal do not fulfil any of the functional categories. Only the university hospital Schleswig-Holstein satisfies seven of the eight functional categories with their offered patient portal. A detailed explanation of given functions in this portal solution will be given in the next chapter.

Category /Hospital	A	B	C	D	E	F	G	H
Charité-Berlin								
University hospital München								
University hospital Heidelberg								
University hospital Freiburg								
University hospital Würzburg								
University hospital Köln								
University hospital Jena								
University hospital Tübingen								
University hospital Erlangen								
University hospital Carl Gustav Carus								
University hospital Leipzig								
University hospital Bonn								
Vivantes								
Pension Fund Knappschaft Bahn-See								
Clinic München								
Health North Clinic Assoziation								
Clinic Nürnberg								
Clinic Stuttgart								
Clinic Region Hannover								
University hospital Schleswig-Holstein	✓	✓	✓	✓	✓	✓		✓

Table 3: Overview of evaluated functional categories and selected hospitals

Table 4 shows the main result of our functional analysis of the five hospital groups in Germany. It is visible that only one group with an existing patient portal partly fulfils the functional categories. The Helios clinic offers a patient portal by fulfilling the marked functional categories in Table 4. This portal fulfils therefore six of the eight categories.

The Helios patient portal does not offer the management of remedies (“Category E – manage remedy”). Besides that, there are no non-personalized health information (“Category G – non-personalized health information”) offered for the patient.

Category /Hospital group	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**
Helios hospital group	✓	✓	✓	✓		✓		✓
Sana Kliniken hospital group								
Asklepios hospital group								
Rhön hospital group								
Agaplesion hospital group								

Table 4: Overview of evaluated functional categories and selected hospital groups

All in all, our analysis shows that the existence of portal solutions in German hospitals is not yet fully developed. The functionalities have to be extended by further research. Also, a market gap of patient portal in German hospitals can be identified. To give an overview of existing functionalities one example is presented as a more detailed case study. The hospital patient portal presented is the one out of the twenty analyzed hospitals that satisfies most of the functional categories.

4.3 The Patient Portal of the University Hospital Schleswig-Holstein

The university hospital Schleswig-Holstein offers a patient portal that satisfies most of the identified functional criteria. The existing patient portal fulfils almost all eight functional categories as described below. The hospital provides the digital service or rather the patient portal "Mein UKSH" for free. The portal is simple to discover and the registration over their website https://portal.uksh.de/webconnect/#/auth guarantees easy access. Digital requests can be made via the mail address info@uksh.de (“Category A – Digital contact options”). The portal can be accessed via different devices (PC, notebook, smartphone or tablet). During the hospital stay the patient can also access the portal via the hospital infotainment system. Via "Mein UKSH" medical documents, findings, radiological images, appointments and dates of the stay are provided after discharge. Therefore, the portal fulfils the identified categories B, C and F. The advantages of the portal are insight and secure access to information about the treatment, as well as online appointment bookings.

To book an appointment online, the patient clicks on the "Termin vereinbaren" tab, where he or she can select the area of expertise, date and the corresponding consultation hours. In the start screen (tab "Meine Gesundheit") of the portal, the patient receives an overview of upcoming appointments, documents, radiology, stays and questionnaires. In the menu item "Dokumente" the patient him- or herself has the possibility to deposit documents. Via "Übersicht" the vital signs BMI, height, weight, blood pressure, heart rate, oxygen saturation, breathing rate, blood sugar and temperature can be recorded (“Category D – Forms online”).

The history can be displayed via "Vitalzeichenverlauf". The tab "Zugriffskontrollle" provides the patient with a list of accesses to patient information, which contributes to self-determined action of the patient's own information (“Category H – Self-determination”).

The possibility of medication management, e.g. by getting an overview of own medication with the help of a medication plan, does exist (“Category E – Manage remedy”). The patient portal of the university hospital Schleswig-Holstein therefore meets seven of the eight established functional categories. Only category G - general non-personalized health information - are not provided (“Category G – Non-personalized health information”) in the portal solution of university hospital Schleswig Holstein.

5 Concluding Remarks: A call for further research on Patient Portals in Hospitals

As shown in the description of the theoretical background, patient portals are still mostly unchartered territory in the field of IS research. This working paper was able to contribute a new categorization grounded in previous research and to establish an overview of the current status quo in practice: Summarizing the results of our research and analysis of the hospitals and hospital groups in Germany regarding our research question we see that there are only a few implemented solutions regarding patient-oriented digital solutions. The infrastructure and patient interaction in German hospitals by offering a patient portal as an interface between hospital, doctor and patient, is currently expandable. The market of existing patient portals in German hospitals is therefore still lacking although the need of digitalization to reduce documentation times and increase patient time is given. The digitalization of patient data to further process the collected data and in this case to reduce documentation time is an important step. This is especially true as even the hospitals that have patient portals do not fulfil all functionalities. Moreover, there is still room for further improvement, i.e. for groups that suffer from the digital divide, e.g., sick or old people albeit research shows that they require particular attention (Niehaves and Plattfaut, 2014).

Naturally, this research comes with a number of limitations: It was not possible to evaluate all 1925 German hospitals (Statistisches Bundesamt Destatis, 2020b) and therefore the overview provided can only be considered an indicator of the total prevalence across German hospitals. Albeit we feel that the most important hospitals which presumably have access to the relevant resources as well a considerable interest in continuous innovation is significant. Also, as the focus was on solutions in place at these hospitals existing vendor solutions that might be deployed in smaller hospitals were not analyzed. And finally, as this research is based on existing literature and extensive secondary data analysis no internal hospital view for example through the means of interviews could be added to complement the picture and maybe answer first questions regarding possible barriers.

Nonetheless these contributions have a significant impact for practice and theory alike: For the practitioner the categories developed and the positive example of Schleswig Holstein may function as a starting point for an internal discussions and considerations regarding the introduction of a patient portal. But to understand the full potential of this type of information system in the specific hospital context, there is still a significant amount of research to be done:

First, we have shown that to date the most important German hospitals and groups do not deploy such a solution in the face of obvious benefits. This makes the question why the number of patient portal solutions in German hospitals is so small inevitable. A possible explanation is that there is not yet enough knowledge and experience – so called best practices – how patient portals with all functionalities can be realized in a German hospital. Hence, further research is needed on success factors, risks and barriers for the introduction of such a system. Here, research could build upon existing results from portal solutions of service companies in other industry.

Second, the lack of research on the design of such patient portals necessitates a call for further design-oriented research on how to build these portals as a patient-oriented digital solution. This is especially true as we assume a positive impact of patient portals, e.g., through reducing duration of administrative processes and through increasing the interaction between hospital and patient. Such design-oriented research needs to include an analysis of all relevant stakeholders from patients to hospital personnel like doctors and care staff. Such an analysis would have to take needs, expectations and underlying process conditions into account to establish a solution that is actually used and creates value.

Finally, both avenues of research would have to include a critical review of hospital processes to optimally include functionalities and avoid digitalization of less than optimal processes. Introducing a digital patient hospital interface opens up a host of new opportunities, be it the automation of currently manual processes like recording the medical history of a patient when entering the hospital for the first time or new possibilities created by the availability of digital first data that can be used to automate back-end processes.

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ERCIS – European Research Center for Information Systems
Westfälische Wilhelms-Universität Münster
Leonardo-Campus 3, 48149 Münster, Germany
P: +49 (0)251 83-38100 F: +49 (0)251 83-38109
E: info@ercis.org W: http://www.ercis.org/

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