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Individuals' Concerns Associated with Digital Healthcare: Professionals' and Patients' Hindrances to Adopt Digital Healthcare Services

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INDIVIDUALS' CONCERNS ASSOCIATED WITH DIGITAL HEALTHCARE: PROFESSIONALS' AND PATIENTS' HINDRANCES TO ADOPT DIGITAL HEALTHCARE SERVICES

Research Paper

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Abstract

Healthcare systems are facing enormous changes as digital technologies find their way to address current challenges. To foster acceptance of digital healthcare services in the future and support the digital transformation of healthcare, it is crucial to understand and overcome individuals' concerns associated with the adoption of digital technologies. This paper presents eleven concerns structured along four categories deduced from an in-depth interview study with 26 healthcare professionals and patients. Further, we mapped these individual concerns as exogenous mechanisms on the well-established Unified Theory of Acceptance and Use of Technologies (UTAUT) and discuss general implications for digital technology adoption in healthcare. Our paper is a first step towards addressing relevant concerns and can be used – either ex-ante or ex-post – to anticipate, explain, or evaluate problems with the adoption of digital healthcare services.

Keywords: Digital Healthcare Service, Technology Adoption, Adoption Behavior

1 Introduction

The healthcare sector has a long-standing reputation for being slow to adopt new technologies (Lucas et al., 2013), yet, finally, digital transformation has arrived (Pucihar, 2020; Vial, 2019). Driven by waves of digital innovations, digital technologies are now helping to realize the triple aim of improving the health of populations, enhancing experiences of care, and reducing the per capita cost of healthcare (Berwick et al., 2008; Barelllo et al., 2015; Devaraj and Kohli, 2000; Sharma et al., 2016). Such technologies enable changes in healthcare value creation paths, as the structure of traditional healthcare services is extended to incorporate additional stakeholders, such as IT service providers. This can lead to positive (e.g., higher productivity) and negative impacts (e.g., privacy-related) for users (Vial, 2019) which can influence their acceptance and use of digital technologies in healthcare.

Regardless of its potential advantages and benefits, if a technology is not accepted – and, thus, not used – it creates no value. Therefore, the acceptance of technology has always been an essential aspect of information system research (Venkatesh et al., 2012), as has the acceptance of digital healthcare services (Hennemann et al., 2016, 2017). Currently, adoption levels of digital technologies (DTs) in healthcare remain relatively low. A 2018 study, for example, reported that 94% of patients in Germany

are concerned about risks to privacy or misdiagnosis when DTs are used in patient consultations (PWC Health Research Institute, 2018). Other studies suggest that only one in ten healthcare professionals (for short: professionals) is highly accepting of digitalization (Hennemann et al., 2017). Subsequent research found similarly low acceptance rates among patients (Hennemann et al., 2018). One approach to analyzing the factors driving the acceptance of DTs is the well-established Unified Theory of Technology Acceptance (UTAUT), which is one of the most widely cited theories in information systems literature (Venkatesh et al., 2003; Blut et al., 2021). The theory defines acceptance as the intention to use technology, directly determined by four different constructs. However, according to Venkatesh et al. (2016) exogenous mechanisms may impact these four constructs in UTAUT. Concerns, defined as the extent to which an individual is anxious about possible risks that may arise associated with the digital transformation in healthcare (Lowry et al., 2011), may constitute such exogenous mechanism (see e.g. Martins et al., 2014) and thus, may hinder the acceptance of a DT. Following the recommendations of Venkatesh et al. (2016) in making a contribution of context-effects to UTAUT, and to provide a holistic perspective of users' concerns associated with adopting DTs in healthcare, we see a need for an integrated, human-centered model that unifies factors influencing professionals' and patients' reluctance over DT adoption in healthcare. Therefore, we choose the UTAUT and not any other technology acceptance model as it provides an holistic insight into all factors, which have influence in the behavioral intention to use a new technology within an organization. Therewith, we aim to improve the understanding of an individual's decision-making process in accepting new technologies relating to digital healthcare services and to enable concerns underlying individuals' reluctance to be addressed. Directly investigating the individual, user-centric perspective will foster a broad understanding of acceptance among users – professionals and patients. Hence, we propose the following research question:

Which concerns hinder an individual's intention to use digital technologies in healthcare?

This research question leads to two research objectives: (1) To uncover concerns contributing to professionals' and patients' reluctance to adopt DTs in healthcare and, as raised by Vial (2019), concerns about resultant negative impacts in the healthcare value creation path. (2) To provide insights on technology adoption issues in healthcare by integrating the identified concerns in the UTAUT proposed by Venkatesh et al. (2003). Therefore, we conduct 26 interviews with the two main user groups of DTs in healthcare – professionals and patients – which allow us insights into users' perceptions. We use open and axial coding to identify concerns from the interview data (Corbin and Strauss, 1990). Drawing on our insights, we derive eleven concerns resulting from the changes in the healthcare value creation path. We then integrate these factors – which we assign to four main categories into the UTAUT.

Our empirical results contribute to both research and practice. This study extends prior research on technology acceptance in healthcare by taking account of users' different perspectives on negative impacts resulting from digital transformation in healthcare. Our work contributes to practice by offering a differentiated understanding of factors that may inhibit technology acceptance.

2 Theoretical background

2.1 2.1 Digital transformation of healthcare services

Digital transformation has emerged as an essential phenomenon in recent years, describing the profound changes related to the use of digital technologies (Majchrzak et al., 2016). Following Vial (2019), we understand the process of digital transformation to comprise eight main components: *digital technologies* create *disruption* triggering *strategic responses* to *alter value creation paths* while *managing structural changes* and *organizational barriers* that affect *positive and negative impacts*. This inductive framework is not domain-specific and, therefore, applicable to the transformations relating to digital healthcare services. And, as Lucas et al. (2013, p. 377), have pointed out: “IT-enabled transformation of health care is just beginning, and it cannot happen too fast.”

In healthcare, the use of digital technologies is also becoming apparent. Digital innovations propel digital transformation towards realizing the triple aim of improving the health of populations, enhancing experiences of care, and reducing the per capita cost of healthcare (Agarwal et al., 2010; Gopal et al., 2019; Berwick et al., 2008). The technologies that Vial (2019) refers to are also present in healthcare: social (e.g., Liu et al., 2017), mobile (e.g., Fedele et al., 2017), analytics (e.g., Kane, 2016, 2017), platforms (e.g., Reuver et al., 2018), and Internet of Things (e.g., Dang et al., 2019).

Consequently, digital technologies in healthcare enable changes in the value creation paths that affect the ways that healthcare services are deployed and newly created. In healthcare, these changes become apparent when looking at the differences between traditional and digital healthcare services. In traditional healthcare services, the primary interactions take place between professionals and their patients. Individuals interact with one another during the provision of medical services, exchanging relevant information and engaging in screening-, prevention-, diagnosis-, treatment-, and care-related service. Therefore, the main flow of information is between these two parties. With the adoption of digital healthcare services, traditional interaction changes as DTs become an integral part of information and communication during healthcare service delivery (Batalden et al., 2016; Srivastava and Shainesh, 2015). Another important stakeholder of digital healthcare services is the service provider, who is responsible for the knowledge, provision, and installation of DTs (Srivastava and Shainesh, 2015). These changes in value creation paths generate both positive and negative impacts (Vial, 2019). An example is the increasing amount of health-related data as a consequence of this newly emerging triangular relationship (Senthilkumar et al., 2018). On the one hand, this offers new ways of providing digital healthcare services to patients (e.g., integrating other professionals or insurances). On the other hand, third parties have more opportunities to (illegally) gain access to the data generated (Abouelmehdi et al., 2017).

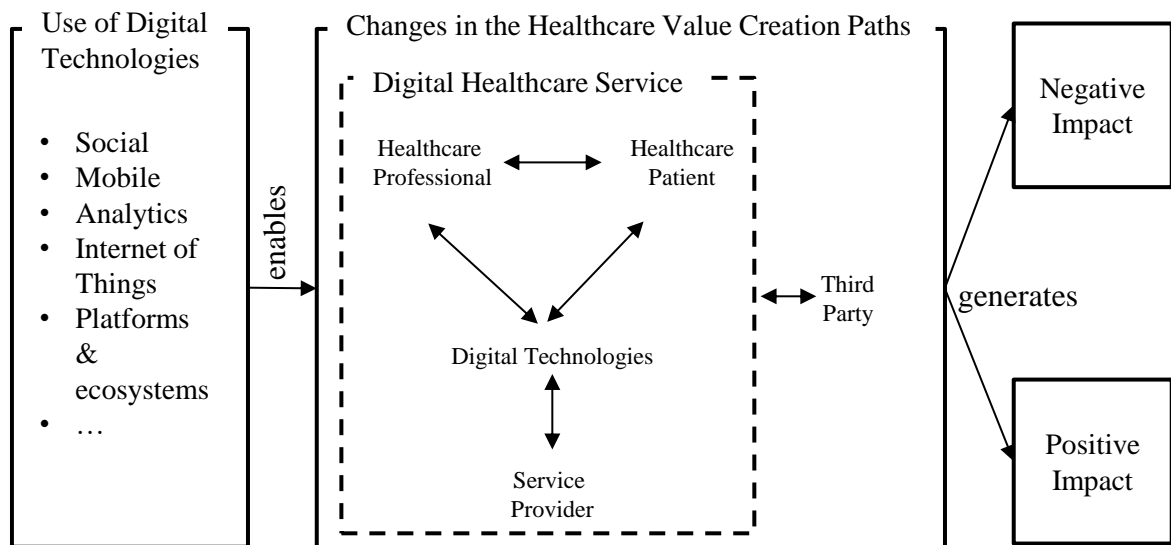


Figure 1. The process of digital transformation in healthcare.

Our study aims to address professionals' and patients' concerns about negative impacts resulting from structural changes in the value creation paths as depicted in figure 1 (Vial, 2019).

2.2 Technology adoption in healthcare

Technology adoption has received widespread attention. The understanding of individual acceptance and use of information technology is now a key research stream within the information system research community (Venkatesh et al., 2012). In general, adoption refers to the decision to use an innovation, for example, a service, product, process, or technology (Frambach and Schillewaert, 2002). The decision may be taken at an individual or an organizational level (Gopalakrishnan and Damanpour, 1997). In this research article, we investigate the decisions at the individual level;

specifically, we examine the perspectives of professionals' and patients' as they represent the main users of DTs in healthcare and, therefore, their acceptance is decisive for technology adoption. Thus, we focus on individual users' perspectives on and concerns about DT's in healthcare.

Research on information systems proposes several theoretical approaches to technology adoption and healthcare uptake at an individual level. Well-established theoretical frameworks, such as the UTAUT (Venkatesh et al., 2003; 2012), operationalize acceptance as the intention to use technology, which is directly determined by different constructs. The UTAUT proposed by Venkatesh et al. (2003) posits three direct determinants of the intention to use a DT, namely performance expectancy, effort expectancy, and social influence, and one direct determinant of usage behavior, namely, facilitating conditions. Later UTAUT extensions include exogenous mechanisms that refer to the impact of external predictors on the determinants of the model (Venkatesh et al., 2016).

The UTAUT aims to explain an individual's decision-making process in accepting new DTs. The theory has been widely adopted, including in healthcare (Wills et al., 2008; Kohnke et al., 2014; Kim et al., 2016; Hoque et al., 2017), where results indicate a positive relationship between the constructs in the UTAUT and users' behavioral intentions (e.g., Wang et al., 2020). Further studies investigate drivers of and barriers to patients' (Ebert et al., 2015; Hennemann et al., 2016; Hoque et al., 2017) and professionals' (Li et al., 2013; Hennemann et al., 2017; Narh and Williams, 2012) acceptance of digital healthcare services, e-Health, or certain healthcare information technologies. These frameworks provide a useful lens to explain technology adoption in healthcare (Hennington and Janz, 2007). However, they must account for the specific technology in focus and its context (Molla and Licker, 2005; Jöhnk et al., 2021). Thus, they either investigate the adoption of a specific DT in healthcare or adopt the above-mentioned theories relating to a specific DT, context, or user group. However, a holistic view that unifies those factors as exogenous mechanisms discouraging users from adopting a DT is necessary to address technology adoption issues in a targeted manner.

Several studies, such as those by Hennington and Janz (2007) and Alaiad and Zhou (2017), use the UTAUT by Venkatesh et al. (2003) to illustrate factors hindering the adoption of technologies in healthcare settings. In some cases, these factors reflect specific properties of the DT, and in others, the context. We aim to build on these studies and apply a perspective independent from a specific DT to investigate concerns related to changes in the healthcare value creation path. Previous studies on technology adoption in healthcare have reported low adoption rates among both professionals and patients. For example, Hennemann et al. (2017) surveyed German professionals and reported that nearly 50 % displayed a low level of acceptance, 40 % a moderate level, and only 12 % a high level. Likewise, patients show similar low-to-moderate acceptance rates of DT adoption in healthcare (Hennemann et al., 2018). Other, more technology-specific literature for example investigated the use of COVID-19 related DTs and reported on differences in DT use and adoption issues (Golinelli et al., 2020) or barriers to electronic health record adoption (Kruse et al., 2016). Thus, a shared understanding of DT adoption issues in healthcare will enable further targeted research and practice to address – and, thus, help to foster – technology adoption in healthcare in the longer term. Specific concerns hindering technology use in the healthcare contexts have been examined in prior research. Privacy, in particular, is a major issue in healthcare due to the sensitive nature of health-related data (Anderson and Agarwal, 2011; Black et al., 2011; Dhagarra et al., 2020). In general, the collection and analysis of personal data are often perceived as negative due to the potential for adverse physical, social, resource-related, psychological, prosecution-related, career-related, or freedom-related consequences for the individuals concerned (Karwatzki et al., 2018). Other concerns affecting technology adoption in healthcare may include the effectiveness of DT in healthcare (Ash et al., 2004; Blachetta et al., 2016; Ariens et al., 2017), the fear of technical failures (Fichman et al., 2011; Khan et al., 2012), and the cost of DTs (Alaiad and Zhou, 2017).

In sum, recent research provides theoretical groundwork on technology adoption in healthcare, and concerns regarding technology adoption by individuals, but does not identify relevant healthcare-specific, technology-independent concerns that impede technology acceptance. Drawing on these previous studies, we seek to provide insights on concerns hindering professionals' and patients'

uptake, stemming from the fear of negative impacts resulting from changes in healthcare value creation paths.

3 Methods

We adopt a qualitative research method in this study to answer our exploratory research question on concerns regarding the digital transformation in healthcare (Bhattacharjee, 2012). Specifically, we use an interpretative research approach based on exploratory interviews.

3.1 Data collection

For this study, we conducted interviews with individual healthcare professionals, including doctors, nurses, and caregivers, and with individual patients from a range of demographic backgrounds. We selected these two groups (professionals and patients) to identify commonalities and differences (Orlikowski, 1993). Among the patients, we also selected a variety of different professions and backgrounds to get a comprehensive picture of concerns. We used purposive sampling to identify our interview partners. The selection of interviewees was based on criteria that the authors believe have an impact on concerns about the use of digital healthcare services, namely affinity for technology, health status, and profession. Affinity for technology is defined as the tendency to engage in intensive technology interaction (Franke et al., 2019; Wessel et al., 2020) and therefore describes the interviewee's attitude towards DTs. The interviewees were provided with the respective definitions and were then asked to make a self-assessment. This allowed us to holistically examine individuals' concerns about the use of DT in healthcare, to engage with the two main stakeholders of a digital healthcare service – the professionals and the patients – and to reflect on the key differences among and between these two user groups.

We continued to collect data until 'theoretical saturation' was reached (i.e., the incoming data from each group was no longer contributing relevant input). In total, we conducted 26 interviews with 12 professionals and 14 patients. The interviews took place either via video-conferencing or in-person. A detailed overview of the interviewees can be found in the [Online Appendix](#).

Each interview lasted between 30 minutes and 50 minutes. The authors conducted the interviews equipped with detailed instructions and a semi-structured catalog of questions to ensure consistency. This approach provided initial guidance and the flexibility to accommodate the unique concerns of each individual. We structured the interviews in two parts: 1) General questions on the topic of digital healthcare services with a focus on the interviewee's experience regarding digitalization in healthcare and daily life, their concerns and hopes for the future; 2) the interviewee's thoughts regarding different digital healthcare services on online consulting, self tracking, digital twin, telemedicine, diagnostic support, bonus programs of health insurances. The services have been selected so that they cover different medical areas and are in line with the latest developments in the field. As language barriers during interviews can present significant challenges to researchers and may lead to misunderstanding (Squires, 2009), all interviews were conducted in the interviewees' native language (German).

3.2 Data analysis

All interviews were recorded and transcribed verbatim. The transcripts were then loaded into the software "f4Analyse," which facilitates the evaluation of qualitative interviews by allowing researchers to organize the different codes and categories identified. We performed an iterative analysis using open and axial coding, following Corbin and Strauss (1990). Firstly, we used open coding techniques to compare opinions and thoughts that our interviewees mentioned, and identified similarities and differences. Therefore, three of the authors each read all interview transcripts to create a common understanding. Next, the authors jointly coded three transcripts to ensure a common understanding. Any phrase that may have proven to be relevant was highlighted as code. Afterwards, the authors individually coded randomly assigned transcripts. In a workshop, the emerging codes were then jointly discussed, compared, and, if necessary, re-named to ensure consistency. In total, the first

round resulted in over 800 codes. Secondly, in eight coding workshops with all four authors, each lasting at least 60 minutes, we jointly paraphrased, condensed, and grouped the codes into themes during axial coding and investigated the relationships between the emerging categories (Corbin and Strauss, 2008). We applied different ways of analysis like the coding paradigm that involves conditions, context, action/interactional strategies, and consequences (Strauss and Corbin 1996) and the dimensioning of codes and concepts (Corbin and Strauss 2008). Therefore, we engaged in ongoing discussions. This resulted in eleven concerns comprising four broad categories. During both coding stages, we also reviewed the literature on general technology acceptance and the digitalization of healthcare services.

As Glaser and Strauss (1968) observed, data collection and analysis are interrelated processes. The process does not merely involve reading an interview and conducting the analysis but consists of multiple steps. These include repeated consideration of the records, the identification of suitable passages, and comparisons with other interviews to identify codes. The aim was to develop a mutually exclusive, collectively exhaustive list of the interviewees' most pressing concerns about digital healthcare services. By doing so, we aimed to identify concerns common to both patients and professionals. If a concern was only held by members of one of these groups, it would show up in the results. However, it turned out that (on a level of abstraction that emerged in the codes), each concern was present for both patients and professionals.

4 Findings

Within the scope of our study, we identified eleven main concerns the digital transformation in healthcare, as perceived by professionals and patients. We assigned these factors, which were identified during the coding process, into four categories that specify fields of action that respond to the occurrence of side effects related to DT in healthcare. Since the elements of the value creation path are interdependent, this also applies to the four categories and the concerns presented therein.

4.1 Psychological-related concerns

Users – namely, patients and professionals – represent the central agent in digital healthcare services. Hence, this category comprises all concerns that directly affect users' personal integrity, self-esteem, dignity, and psychological health.

Discrimination describes the individual's concern that a user or user group will be treated differently, and notably worse than others (Peña Gangadharan and Niklas, 2019; Anderson et al., 2003). Increased use of DTs in healthcare might lead to different medical services being made available to different groups of patients. This may relate to individual factors such as income, age, and affinity for technology, which can prevent or hinder access to and the use of DTs, resulting in the exclusion of certain patients or patient groups from the latest standard in healthcare. For example, the elderly might constitute such a risk group since their affinity for technology is often low: "*Elderly generations [...] can [probably] not make use of digital healthcare services [as some of them] cannot even operate their mobile phones. Hence, the provision of digital healthcare services is an idea that is not beneficial for everyone*" (Professional 4). Patients expressed fears of being treated differently by others, including professionals or acquaintances, due to individual factors: "*Then if I don't want to or can't use a service because it's too expensive or burdensome for me, am I a second-class patient?*" (Patient 12). The factor underlying this hindrance is the concern of negative impacts on the relationship between professionals and patients (Hennington and Janz, 2007).

Losing the autonomy to act, either objectively or in the user's perception, is a feeling of reduced individual freedom from external control or influence, resulting from the use of DT (Gimpel and Schmied, 2019). Firstly, professionals reported concerns about losing their objectivity, as DTs in healthcare offer service providers an opportunity to place targeted advertisements. The professionals spoke of their fear of being influenced or even manipulated to use a specific, promoted product rather than follow their own opinion on the best options for their patients. Professional 2 gave us a vivid

example of a system for managing surgery that he uses in his daily work. This software “[...] is sponsored by several pharma companies and on the sides [of the screen] the relevant advertisement is displayed. Hence, when [the software] notices, with the help of the information from the patient file, that the patient has diabetes mellitus type II, it displays a fitting advertisement. Alternatively, for a patient with problems of the thyroid glands, when it is noted in the patient file as a diagnosis, suddenly an advertisement for L-Thyroxin [...] appears on the right-hand side”. Similar remarks are also made by patients, who consider that “companies are better at personalized advertising and try to influence [patients]” (Patient 6). Another issue concerns the ease of access to, and richness of, patients’ information. The overload of information can make it hard for professionals to objectively and thoroughly process all the information necessary to make a decision. For example, Professional 1 claimed that “when a reviewer is writing a report and gets access to all patient data beforehand, is he then still truly objective?”. The fear of losing autonomy to act stems from a growing sense that professionals are no longer the only agents holding power in decisions about their patient’s treatment, or from questions about their ability to make decisions without being manipulated. Underlying this concern is that decisions are not being made based on what practitioners feel is best for the patient but, instead, on what providers, health insurers, or the like dictate or suggest subtly. This may negatively impact the performance and quality of digital healthcare services and may, thus, impede DT adoption in healthcare (Venkatesh et al., 2003). It may also negatively influence the professional-patient relationship as patients may lose trust in the professional’s decisions.

Data fixation describes users’ fear of being heavily dependent on their digital healthcare applications and the resulting data. DTs make it possible to capture a massive amount of health-related data. This risks reducing professional and patient perceptions of a patient actual health status to what is recorded and communicated in the form of data via DTs (Gimpel and Schmied, 2019). Patients may be overly concerned with their health status, for example, Professional 6 stated that the use of DTs for self-tracking purpose “can lead to a lot of focus on one’s day-to-day well-being, which usually leads to the development of a very introspective personality that no longer becomes free and independent of the disease.” Likewise, professionals may be overloaded by their patients’ data, or focus too much on previous patient’s data. Professional 12 argued: “Of course, it is good to learn as much as possible about the health background of my patient. But if a device gives me all this information, unfiltered, I will certainly be overloaded by all the information. I would rush through all the data and probably forget the most important thing: the patient and the conversation with the patient.” Patients, in particular, are concerned that “the professional is passing the responsibility, and follows the system’s decision/suggestion” (Patient 1). Behind this is the professionals’ and patients’ concern of being too fixated on the data and missing important details on the patient available only at the interpersonal level. Additionally, it comprises patients’ concerns about “rely[ing] too much on digital healthcare applications” (Patient 8), which, in the worst case, might lead to “not noticing if the system does not work correctly and delivers wrong measured values because you have lost your sensitivity” (Patient 8 on diagnostic support). Both aspects might negatively impact the performance and quality of a digital healthcare service, for example, when patients lose their sensitivity, which may impede DT usage.

4.2 Technical-related concerns

The newly introduced central agent in digital healthcare service is the digital technology itself. Concerns in this category comprise three aspects of DT use: a failing DT, a user that fails to use a DT correctly or issues with data quality. These concerns also reflect current research on technostress (Ragu-Nathan et al., 2008; Ayyagari et al., 2011).

Unreliability of DTs describes all concerns accompanying the increased effort to offset technical problems such as crashes, hang-ups, or bugs (Ayyagari et al., 2011). The risk of technical problems bothers professionals as “there is always the risk that the computer crashes or that there are other technical problems [and] that is a [...] big problem [...]. That is very dangerous” (Professional 2 on electronic health records). In addition to problems that can arise during the use of DTs, patients are also generally concerned about whether DTs function reliably or whether they have been “poorly

developed [...] and treatment errors occur as a result" (Patient 6). Firstly, this concern stems from a fear that healthcare services may not be available due to a failing DT that cannot easily be repaired. Thus, the unreliability of DT can have negative impacts on performance. Secondly, the factor reflects users' concerns about the effort needed to fix a failing DT during the service. Thirdly, it refers to an overall concern about whether the DT has been developed in such a way that it can reliably deliver value for the user (e.g., assessing correct data, determining appropriate treatments).

The **lack of user competence** comprises all concerns about errors that occur due to the uninformed, or inexperienced application of DTs in healthcare services, and relates to concerns about the complexity of DT. Users may feel that their DT skills are inadequate (Ragu-Nathan et al., 2008; Ayyagari et al., 2011). For example, patients express concern that they are *"unsure whether professionals are genuinely competent"* (Patient 14) or about their own abilities, and whether they are *"even able to deal with the complexity"* (Patient 1). In short, both patients and professionals may be afraid that they are not experienced enough to handle digital healthcare services due to the complexity of DTs. Yet, rather than admitting a lack of experience, some users may pretend to be *"experienced in using a technology, however, they are not. This can lead to huge problems due to incorrect application"* (Professional 7). Like the above-mentioned concerns about unreliable DTs, the lack of user competence may lead to performance-based and effort-based impacts when individuals use a DT in the wrong way or not as intended by the DT provider. This, in turn, may inhibit DT adoption in healthcare.

Data quality issues describe users' concerns about obtaining the data necessary for service provision. This relates to concerns about whether data from DTs and patients can be collected accurately and reliably. Patients are concerned that, for example, data reflects *"symptoms [...] described inaccurately [by patients], resulting in an inappropriate diagnosis"* (Patient 9 on diagnostic support). Other patients hold a similar perspective, emphasizing the aspect of the increased physical distance between patient and professional: *"I am worried that the doctor will receive too little or unreliable information if he does not see me in person"* (Patient 4). Likewise, professionals may question whether *"data is still reliable" as it is "highly subjective and collected by [medically] unskilled users"* (Professional 11). Underlying this concern is the user's responsibility for qualitative data and the fear of trusting inferior data, which may lead to a decrease in the quality of the healthcare service.

4.3 Privacy- and security-related concerns

The use of DTs leads to an increasing amount of medical information elicited and personal data collected. Hence, concerns in this category comprise concerns stemming from the amount and variety of collected data and the integration of new stakeholders. Users fear that these stakeholders may (illegally) gain access to data which they may use for their own purposes, including to manipulate, invade privacy, or exercise power.

Invasion of privacy refers to concerns about data privacy – in particular, illegal accessing and use of personal, health-related data by third parties (Anderson and Agarwal, 2011; Black et al., 2011; Dhagarra et al., 2020). The increasing flow of information in digital healthcare services enables third parties, such as the service provider of the DT, to come into possession of patient data, leading to an increased risk of data leakage and, hence, abuse leading to privacy infringements. Individuals expressed concerns about the amount of sensitive, personal health-related data that may be misused or disclosed. Patient 3 explained: *"Collected data is not analyzed independently but is combined with other data from you. Thereby, much additional information can be generated."* Professionals also expressed an awareness of the sensitivity of patients' data: *"The moment a global computing or internet concern develops [...] a digital healthcare application; the question arises: Where are the loopholes? I am sure they are there. Even if it appears to be anonymous, I would never advise my patients to implant [such] a device [...] in their body as the company will get the power over the patient's data"* (Professional 2 on diagnostic support). Underlying this are concerns about an adverse exchange, social exclusion due to health-related data made publicly available, and the loss of one's privacy.

Data manipulation refers to concerns about third parties gaining illegal access to stored data and using it to maliciously manipulate the data's owner or the data itself (Agrawal and Alharbe, 2019). Medical instructions, decision-making support systems, or dosages can be manipulated or changed by third-party datahacking, which can have disastrous consequences on the patient's health. Patients raised concerns that the use of DTs in healthcare means that “[data] manipulation becomes easier” (Patient 2). Such concerns become even more significant when patients “[...] imagine what would happen if a system or device gets hacked” (Patient 1). Behind this lies a concern about significant, performance-based consequences for a patient's health and life.

Super-powerful health insurance describes a concern about the increasing power of health insurance (Gimpel and Schmied, 2019). Health insurance companies have more access to individual patients' health data and other personal information, which they can use to their own advantage. Many of the interviewed professionals raised the concern that patients could be excluded from insurances or have problems being accepted by new healthcare insurance schemes if insurers gain access to particular health-related information. As one professional asked: “Does the doctor have to justify himself to the health insurer to get the financing for his patient's care?” (Professional 1). Although insurance companies assure patients that they do not have to fear adverse effects from sharing their data, patients remain suspicious “which other benefits can health insurers derive from that data” (Patient 4 on bonus programs) – particularly in the future when data analytics provides new opportunities to handle the massive amounts of emerging data. Underlying this concern is a fear of being dependent on health insurers. After all, if health insurers become too powerful, it may negatively impact the performance of a healthcare service, e.g., if cost coverage is refused.

4.4 Resource-related concerns

DT use requires specific resources, such as money, time, and know-how. Thus, it comprises all concerns referring to users' lack of resources. In contrast to the other concerns, those in this category can directly impact a user's DT use-behaviour (Hennington and Janz, 2007).

Financial effort refers to the consequences of investing money in DTs in healthcare (Jöhnk et al., 2021; Hennington and Janz, 2007). Professionals and patients must invest financial resources if they wish to use DTs in healthcare services. The lifecycle of DTs is short, and constant advancements in the field mean constant investments are necessary to keep up with the newest technologies. As Professional 10 explains: “You always have to stay up-to-date and keep up with all the developments in the digital field. These can lead to high costs for practice operators, for example.” Monetary constraints and low budgets can prevent professionals and patients from adopting and using a DT in healthcare services. Such constraints can lead to difficult choices, particularly as some patients argue that, from their point of view, “it is unclear whether it is worth the financial effort at all and whether the service will be better than before” (Patient 1). Thus, the financial effort may be classified as a facilitating condition that can directly hinder DT use-behavior (Hennington and Janz, 2007).

Time effort refers to the time required to familiarize oneself with and learn to use a particular DT, and to handle malfunctioning DTs (Hennington and Janz, 2007). However, time is a scarce commodity, especially for professionals in healthcare contexts. As a consequence, some professionals pretend to be “against the introduction [of DTs] because it takes so much time to set up and learn everything. I prefer to spend this time taking proper care of my patients” (Professional 7). Similar thoughts were also expressed by patients, who found it “difficult to imagine how the physician is supposed to devote time to the introduction and then deal with [the DT] in terms of their time” (Patient 1), and questioned “whether enough time is invested by [patients and professionals] to deal with the [DTs] in a meaningful way” (Patient 4). Like financial constraints, time constraints may be classified as a facilitating condition that can directly hinder DT use-behavior (Hennington and Janz, 2007). Even if professionals and patients are willing to adopt a DT, they cannot do so if they do not have the time.

5 Discussion & Implications

Our study builds on earlier research on digital transformation by Vial (2019) that observes changes in the value creation path. Considering the nature of the healthcare sector, we highlight an important perspectives on adopting DTs in this specific field. Our results yield a holistic, unified understanding of concerns specifically hindering DT used in healthcare that emerge as a result of including DTs in the healthcare value creation path. Some of these concerns are not new to research on healthcare services and have been discussed in prior literature in the wider context of ongoing digitalization in healthcare (Khilnani et al., 2020; Esmaeilzadeh, 2019). These include, for example, the unreliability of digital technologies or users lacking in competence in terms of their implications on technostress (Ragu-Nathan et al., 2008; Ayyagari et al., 2011), discrimination based on individual differences (Anderson et al., 2003), and concerns about privacy issues, data manipulation, and security breaches (Appari and Johnson, 2009; Abouelmehdi et al., 2017). In many technology adoption models, the ability to master a technology is modeled as strong predictor of technology adoption behavior (Taherdoost, 2018). Although self-efficacy per se is not modeled as a separate concern in this paper, it is reflected in many of the proposed concerns e.g., from a technical perspective (see “lack of user competence”) or from a psychological perspective e.g., “data fixation”.

The results of our exploratory interview study have enabled us to identify eleven concerns providing clear reasoning for the adoption problems of DTs in healthcare. Yet, beyond recognition of these specific concerns, DT adoption in healthcare entails an understanding of their implications for an individual’s intention to use a DT. Thus, the fact that concerns about negative impacts resulting from the use of DTs can hinder the adoption of DTs in healthcare (Hennington and Janz, 2007) emphasizes the need to specifically consider DT adoption in healthcare. Based on our results, we suggest a future research model for the empirical validation of the relevant adoption factors.

5.1 Conceptualizing individual factors relating to DT adoption in healthcare

We argue that the eleven concerns identified in our study impact the four main constructs performance expectancy, effort expectancy, social influence, and facilitating condition from the UTAUT (see figure 2). On this basis, we suggest that concerns hindering individuals impede the individual’s behavioral intention to use a DT, and negatively influence use-behavior (Hennington and Janz, 2007; Venkatesh et al., 2003).

Firstly, our analysis revealed five concerns related to the performance expectancy of a digital healthcare service, which we suggest influence professionals’ and patients’ behavioral intention to use DTs in the context of healthcare services: losing the autonomy to act, data manipulation, super-powerful healthcare insurers, the unreliability of DTs, and the lack of user competence. Performance expectancy is shaped by the individual’s perception of the outcome of a digital healthcare service, and, thus, by improvements in the quality of the healthcare service (Hennington and Janz, 2007). However, professionals and patients fear that the adoption and use of DTs in healthcare may negatively impact the performance and outcome of a digital healthcare service, which may have implications on their behavioral intention to adopt DTs (Venkatesh et al., 2003; Hennington and Janz, 2007).

Secondly, our study highlights two concerns related to the effort expectancy associated with a digital healthcare service, namely, the unreliability of DTs and the lack of user competence. Effort expectancy is shaped by the individual’s perceptions of the ease-of-use of a DT (Hennington and Janz, 2007). However, professionals and patients are aware of the efforts involved in adopting DTs. Thus, similar to performance expectancy, effort expectancy can hinder the individual’s behavioral intention to adopt DTs in healthcare (Venkatesh et al., 2003; Hennington and Janz, 2007).

Thirdly, we highlight two concerns that impact social influence, namely, discrimination and invasion of privacy. Venkatesh et al. (2003) define social influence as the way in which individuals believe others will view them when using a DT, and conceptualize it using subjective norms, social factors, and image. Hennington and Janz (2007) highlight relationships with others, e.g., the relationship

between physician and payer can impact social influence, affecting an individual’s intention to use DTs.

Lastly, we suggest two factors relate to the facilitating condition: time effort and financial effort (Hennington and Janz, 2007). These factors are commonly mentioned as a hindrance to DT adoption and directly impact an individual’s use-behavior (e.g., Bria, 2006; Leung et al., 2003; Mutlag et al., 2019; van Ginneken, 2002).

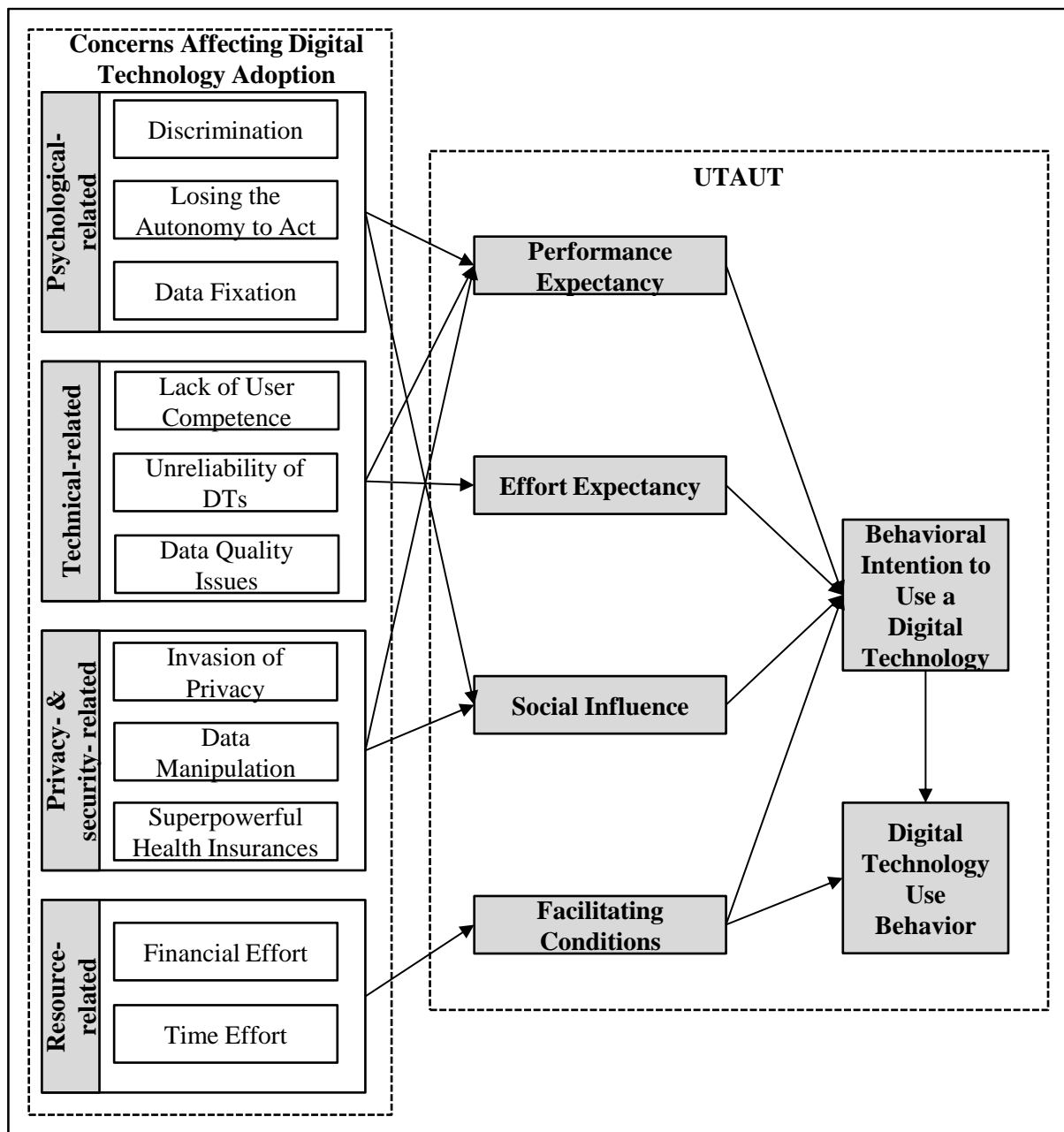


Figure 2. Concerns affecting the adoption of DTs in healthcare.

To unify the process of digital transformation by Vial (2019) and the impact of concerns on individuals’ intention to use DTs in healthcare, we propose figure 3. Patients’ and professionals’ concerns about negative impacts on the four categories *users*, *digital technologies*, *data*, and *resources* stem from the changes in healthcare value creation path and may lead to negative impacts. These impacts are reflected in the four main construct of the UTAUT.

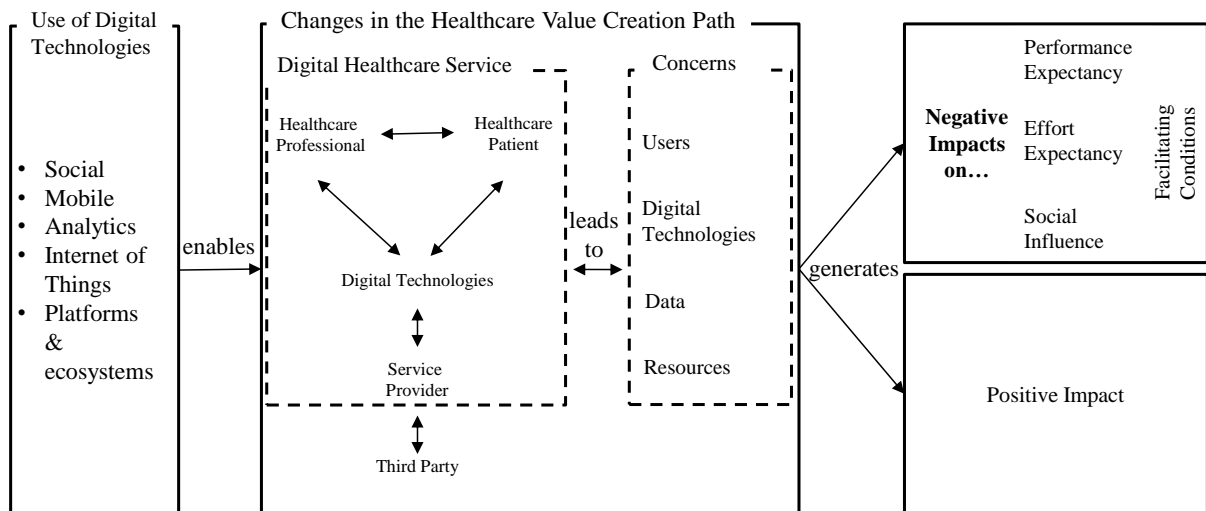


Figure 3. Model of individuals' concerns associated with the digital transformation in healthcare

5.2 Implications & limitations

Prior studies have revealed a low level of acceptance of DTs in healthcare among professionals and patients. To date, most studies on the acceptance of DTs in healthcare have focused on a certain DT or a specific context to examine technology adoption. However, a holistic understanding of DT adoption in healthcare is still missing. At the same time, however, technology acceptance is essential to exploit the potential that digitalization holds for healthcare services. By using an interpretive approach, our study was able to capture and gain insights into how professionals and patients feel about structural changes in the deployment of healthcare services. The use of interviews allows us to explore and understand professionals' and patients' concerns associated with the digital transformation in healthcare. Against this background, our research makes the following three contributions.

First of all, we identified eleven different concerns that prevent patients or professionals from using digital healthcare services. These concerns reflect the fear of structural changes in healthcare services. By providing a unified overview of the concerns, our research will help efforts to prioritize and address concerns held by both patients and practitioners.

Secondly, with the insights from our study, we now provide the additional empirical groundwork for theorizing technology adoption in healthcare and extending the digital transformation framework posed by Vial (2019). The four categories summarizing the concerns allow to better understand how changes in the value creation path can lead to negative impacts and, thus, specify the building block negative impacts in the framework posed by Vial (2019), specifically for the context of digital healthcare services. With our study, we make a contribution of context-effects in UTAUT, provide a healthcare-specific understanding of technology acceptance, and identify new context-effects theory (Venkatesh et al., 2016). This will open up new opportunities for future research: by contributing to our context-effects and applying it to other domains, a new theory on how concerns regarding negative impacts of DT use may influence technology acceptance (Venkatesh et al., 2016).

Thirdly, our study enriches insights from previous research by defining individual concerns as new exogenous mechanisms that influence the UTAUT (Venkatesh et al., 2003; Venkatesh et al., 2016). Therewith, we follow the recommendations of Venkatesh et al. (2016) and conceptualize individual technology use at the feature level and use UTAUT as the baseline model. While several prior studies have applied technology acceptance models like the UTAUT to the healthcare context (e.g., Wills et al., 2008; Kohnke et al., 2014; Phichitchaisopa and Naenna, 2013), we contribute to the current literature on technology use in healthcare by providing an integrated and context-independent consideration of technology acceptance and users' concerns in healthcare. This allows the

development of research models for the empirical validation of the relevant concerns accompanying the digital transformation in healthcare.

To summarize, while we have focused on the so-far underdeveloped understanding of digital healthcare's dark side, future research may integrate the concerns and risks with standard technology acceptance models.

With regards to practitioners, there are two main stakeholders for our study: (1) service providers and chief executive officers in healthcare planning aiming to integrate DTs in their services and (2) the users, namely professionals and patients. Firstly, DTs and digital services can offer benefits. However, there are examples of promising innovations that failed to diffuse because key actors were reluctant to use them (Angst and Agarwal, 2009). Thus, users' acceptance is crucial, and our study provides insights into major concerns. Our framework can be used – either ex-ante or ex-post – to explain, anticipate, and evaluate problems when switching to digital healthcare services. The early investigation of concerns among users is of great importance. It is an opportunity to, ex-ante, take concerns about risks into account when digital healthcare services are developed, and users can provide explicit information about these concerns. If acceptance is low, an ex-post evaluation of the reasons can be carried out. Secondly, the concerns can, likewise, improve the doctor-patient relationship by making doctors more aware of the concerns and risks that patients deal with and, hence, address these concerns more effectively. This also enables patients to obtain more targeted information about possible risks and to address or weigh up their concerns in a targeted manner regarding the respective digital healthcare service.

Our study has some limitations, which we believe offer opportunities for future research. Firstly, the purpose of our study was not to achieve statistical validation. We aimed to discover patterns for theory building and to gain a better understanding of the main issues in this context. It is reasonable to assume that our framework's insights will guide future research to develop a more formal theory (Orlikowski, 1993). Thus, we encourage future research to collect and test additional data to further clarify our findings and further incorporate the framework into theory. Likewise, more empirical and theoretical work is needed to more closely examine relationships among the eleven concerns. In particular, complementary methods such as surveys or experiments could be used to extend our findings. Secondly, this study was conducted in only one country, only with native speakers, has a female bias, and has a relatively small sample of interviewees. Future research should examine larger samples with regional and cultural differences to test the generalizability of our results. Third, our sample consists of individuals with a wide range of professions. Future research should account specific professions to get a clearer picture of occupational differences. Further, the investigation of other influencing factors may be highly relevant in future research. Fourth, we have limited our study to identifying professionals' and patients' concerns regarding digital healthcare services. Therefore, applying our results to other domains will contribute to a new UTAUT extension on the influence of concerns regarding negative impacts emerging through digital transformation on technology acceptance (Venkatesh et al., 2016; Vial, 2019). Lastly, our study takes an overarching, general perspective on the topic. Therefore, we encourage future research to use our study as a starting point for going one step further towards understanding and addressing these concerns, e.g. by taking demographics, individual prerequisites or specific types of digital technologies into account or by analyzing differences in the perception of the concerns between both stakeholder groups.

6 Conclusion

New DTs are providing more and more opportunities to tackle major problems in healthcare. They provide promising opportunities to realize the triple aim in healthcare – care, health, and cost – but only if they are accepted by users. However, users' willingness to adopt new DTs is often limited due to concerns specific to the context of healthcare, not least the sensitivity of health-related data. We believe that our study offers a starting point for future research on this topic and hope that it will help to foster technology adoption in healthcare.

7 References

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