

The patient will see you now – Towards an understanding of on-demand healthcare

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Abstract—*The increasing prevalence and ubiquity of digital technologies is changing the needs and expectations of patients towards healthcare services. As a result, a plethora of patient-centered services edges into the healthcare market. Since digital technologies bear the potential to surmount barriers in time and space, patients increasingly demand real-time or near-time healthcare services. Amongst a cloud of related concepts in the context of digital health, one term increasingly typifies this impulse: on-demand healthcare. While this term can be noticeably found in practice, there is hardly some theoretical foundation so far. Against this background, the aim of this paper is to address this research gap and to explore the phenomenon of on-demand healthcare. Based on a design-science approach including a literature review and analysis of in-depth interviews and empirical cases, the outcome of this paper is twofold: (1) a conceptual framework and (2) a proposal for a definition of on-demand healthcare.*

Keywords—on-demand healthcare, digital health, mHealth, smart health, connected health, healthcare technologies

1 Introduction

The ongoing digitalization massively transforms the healthcare sector in various ways. Mobile applications and devices, communication technologies, and the ongoing progress of data processing capabilities pave the way for new forms of diagnosis, monitoring and treatment of diseases [1][2][3]. Moreover, the increasing prevalence, availability and ubiquity of digital technologies is changing the needs and expectations of patients towards healthcare services [4]. As a result, a plethora of patient-centered services, products and business models edges into the healthcare market from global tech companies and small startups likewise. Thus, patients can choose from a large portfolio of digital products and services to access information or employ other services of (digital) healthcare providers [5][6]. Like in other industries, new (small and big) tech players enter the market with innovative and convenient technologies and applications and thus entirely change the conventional value networks [7][8][9]. Consequently, digital health has become a prevalent, wide and multidisciplinary research stream in recent years and concerns the disciplines of medicine, economics, and business informatics likewise. IS and BI related research has repeatedly emphasized the importance of digital health ([10][11][12][13] [14]) since digital technologies can potentially reduce and manage healthcare costs or enhance healthcare quality [15]. The implementation of digital technologies exhibits various different effects [16] with enormous impact on the economy and society likewise [17].

Most of all, they bear the potential to surmount barriers in time and space. Hence, patients increasingly demand such services in real-time or near-time with a convenient and seamless user experience [18]. Amongst a cloud of related concepts in the context of digital health (such as mobile health, or smart health), one term increasingly typifies this impulse in particular: *on-demand healthcare*. This term can be noticeably found in practice. According to Accenture it is the second-fastest growing segment of the on-demand economy [19]. In contrast, there is hardly some theoretical foundation so far, although some contributions indicate that research in this field is required (e.g. [10][11]). Against this background, the aim of this paper is to address this research gap and explore the phenomenon of on-demand healthcare. Based on a systematic analysis of available literature and empirical evidence, the outcome of this paper is twofold: (1) a conceptual framework and (2) a definition of on-demand healthcare. The rest of the paper is structured as follows. In Section 2, we describe our methodical approach. In Section 3, we discuss the results of our exploratory mixed-methods approach of screening available literature and elevating empirical insights. In Section 4, we proceed with synthesizing the results of our analyses by means of a conceptual framework and a definition of on-demand healthcare. In Section 5, we come up with a conclusion and an outlook for possible future research.

2 Methodical Approach

We address the research gap and systematically explore the phenomenon of on-demand healthcare with an explorative and qualitative design-oriented approach in order to gain a deeper understanding in terms of analysis and explanation [20]. Design science research allows the development of both theories and artefacts that lend utility to practice. It requires a comprehensible, rigorous design and evaluation of artefacts as an approach to solve important, relevant business problems in a specified environment [21]. Basically, these guidelines can be condensed into three activities: systematic artefact construction by practice or theory-based insights, evaluation of the functional performance, and reflection on results [23]. Results can be models, methods, constructs or instances [24]. Following these guidelines, we conducted a structured mixed-methods research design consisting of two phases: exploration and synthesis (Figure 1). The *exploration phase* contains four basic pillars: analysis of closely related definitions; literature review of on-demand healthcare; conduction and analysis of in-depth expert interviews; screening and analysis of empirical digital health applications.

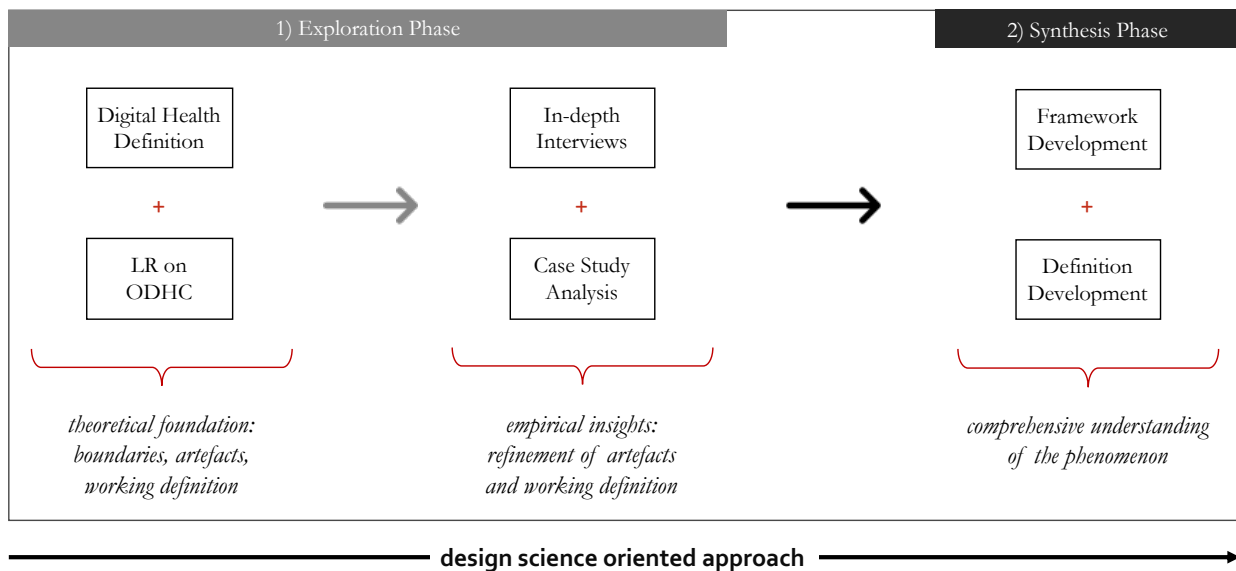


Figure 1: Research Design

Hence, we first explored and analyzed available definitions of closely related terms, i.e. digital health, eHealth, mHealth, smart health, health-IT to frame and narrow the definition space of on-demand healthcare. At this, we mainly stuck to available literature in the field of IS and BI, starting with a comparative overview on eHealth from [25] and further concentrating on applicable research agendas (e.g. [11]) and comprehensive articles in encyclopedias (e.g. [26]). As part of this analysis, we could determine the general scope and boundaries of on-demand healthcare.

Second, we conducted a systematic literature review with the goal of better understanding the new phenomenon [27] of on-demand healthcare. Based on Cooper's Taxonomy [28], we put a focus on research outcomes and theories to identify central issues from a neutral perspective. We apply a conceptual approach to identify artefacts (drivers and components) of on-demand healthcare from a representative coverage of research contributions in the context of digital health to develop an understanding of on-demand healthcare for both general scholars and practitioners. Following the guidelines of [29], we conducted an incremental search, which first involved an exhaustive keyword search within the abstracts, titles and keywords of academic papers by using the relevant databases (i.e. aisel, Ebscohost, IEEE Xplore, Wiley, JSTOR, Springer) and the following string: ("on-demand") AND ("health*" OR "doctor" OR "physician"). From 35 identified academic contributions only six proved relevant in covering on-demand healthcare in a narrower sense. That is why we broadened our literature search by practical contributions on on-demand healthcare. We applied a concept-oriented approach to identify prerequisites, drivers, characteristics and goals of on-demand healthcare services. On the basis of our first two analysis steps, we developed a working definition of on-demand healthcare in preparation for the subsequent steps.

Third, we conducted in-depth face-to-face interviews with 14 international digital health experts at HPI-Mount Sinai Digital Health Forum 2019 to capture and conceptualize their understanding of on-demand healthcare. Among the experts were founders of digital health startups, scientists, hospital CIOs and representatives from ICT providers, payers and responsible government authorities. We followed the guidelines from [30] and designed a deliberate mix of open and closed questions in order to explore and collect broad but purposeful information from the interviewees. Thus, we interviewed the experts for approximately 20-30 minutes to zero in on four segments of on-demand healthcare, i.e. general understanding, expected time scope, required building blocks and perceived impact factors. At the end of the interviews, we confronted the experts with a working definition of on-demand healthcare to ask for amendments or extensions. This way, we contrasted the open and explorative questions with graspable content. We recorded the interviews for transcribing and inductively coding the answers in the aftermath to appropriate classes within the respective question segments.

Forth, we identified and analyzed (mainly mobile) digital health applications, which exhibit latent characteristics of our working definition. This implies a qualitative case-study analysis, following the guidelines from [31]. A multiple-case study can prove useful to approach scarcely explained phenomena by developing or testing theory from empirical data. Therefore, carefully selected cases can contribute to systematically conceptualize new phenomena [32]. Accordingly, we conducted an internet search to identify common digital health applications with varying value propositions. We analyzed 16 of such services with respect to their required resources in order to explore further or more detailed prerequisites, drivers, characteristics and goals of on-demand healthcare which helped us gaining a broader and more tangible understanding of on-demand healthcare.

As part of the *synthesis phase*, we systematically coded, categorized and aggregated our findings from all four pillars to derive a comprehensive overview of the predominant artefacts (i.e. prerequisites, drivers, characteristics and goals) of on-demand healthcare. In a second step, we conceptualized these artefacts and condensed them into a coherent framework and a definition of on-demand healthcare services to provide a graspable result of our efforts, which might prove useful for further research in this context.

3 Exploring On-Demand Healthcare

3.1 Definition of Digital Health

In order to determine the boundaries for conceptualizing on-demand healthcare, we first come up with a general understanding of digital health. Digital health is often referred to as eHealth or health-IT [26] and covers a broad range of approaches (e.g. patient-centeredness [4]), concepts (e.g. personalized health [1][33]) and technologies (e.g. 3D Printing [34]). In IS and BI related research, a plethora of definitions for digital health and eHealth is available which all have a combination of health and the use of technologies in common [25]. In line with that, the World Health Organization defines digital health or eHealth as the cost-effective and secure use of information and communications technologies in support of health and health-related fields.

Some research contributions have yet conceptualized the broad field of digital health. For instance, [11] have scrutinized digital health regarding its impact (i.e. quality and economics of healthcare) and its adoption (i.e. level and barriers). Fichman et al. [10] have analyzed the role of IS in healthcare. Thus, the first determined the underlying conditions of healthcare (which is highly personal, competitive, regulated, multidisciplinary, hierarchical and complex) and the proposed potential research opportunities as IS can help to exploit social media for healthcare, enhance evidence-based medicine and facilitate personalized health.

Gersch and Wessel [26] basically break up the term digital health into *health-IT* and *eHealth*. While health-IT refers to the health-related technical artefacts to support business and care processes as a decisive pillar of digital transformation in health [35], eHealth applies to resulting economic, social and societal effects and consequences. Thus, digital health is an umbrella term for the use of different IT and IS based artefacts and solutions in healthcare. For one thing, this includes systems closely related to health (e.g. telemedicine, hospital IS, electronic health records). For another thing, it also applies to general digital technologies which diffuse into healthcare (e.g. internet of things, ubiquitous computing).

According to the definition of [26], the following artefacts have to be taken explicitly into consideration in the context of digital health:

- *telematics infrastructure* as an essential basis for intersectoral communication and digital health systems and applications;
- *telemedicine* as the use of ICT for healthcare services to remove barriers in time and space;
- *clinical pathways* as an equivalent for process management and a systematic analysis, development and improvement healthcare-related processes;
- *healthcare-specific IS* (esp. for hospitals and clinics) for the support and administration of healthcare-related processes;
- *electronic health or patient records (EHR/EPR)* for the individual documentation of patient history to support healthcare both directly (i.e. anamnesis, diagnosis, treatment) and indirectly (i.e. communication, coordination);
- *health apps and mHealth* as a result of the pervasiveness and ubiquity of smartphones and other wearables for supporting documentation, detection, communication and self-management;
- *health platforms* to ensure interoperability and facilitate intermediation among systems, applications and stakeholders in healthcare;
- *health communities* through the usage of social media platforms and applications.

As a result, digital health embraces a bunch of different concepts, methods and systems, which therefore constitute a natural boundary for the understanding of on-demand healthcare. Some of these concepts and terms seem to be closely related to on-demand healthcare, others not. If and to what extent, will be elaborated in the following sections.

3.2 Literature Review: On-Demand Healthcare

After having defined the boundaries of on-demand healthcare, we screened available literature on this phenomenon. Although there is a plethora of digital health literature available and many topics seem to be attached to on-demand healthcare (e.g. smart health, telemedicine), concrete IS-related academic literature on this phenomenon is virtually non-existent. IS-related contributions, which refer to that term, do not come up with a definition of on-demand healthcare. For instance, [36] explore the effects of integrating patients in the development of on-demand webcasts. Zao et al. [37] describe the development of a platform for on-demand healthcare applications for smartphones and wireless sensor networks. However, both contributions mainly stick to telemonitoring and remote healthcare in their explications, which might be components of on-demand healthcare but do not necessarily constitute it. Likewise, [38] apply a sensor fusion method to detect depressive disorder with incomplete datasets. They outline the role of (biomedical) cloud computing as a prerequisite of on-demand healthcare, but do not deliver a definition or description.

In contrast, [18] seems to refer to the concept of on-demand healthcare from a generic and conceptual standpoint but proposes the term *pervasive healthcare* as "healthcare to anyone, anytime, and anywhere by removing locational, time and other restraints while increasing both its coverage and quality", including prevention, healthcare maintenance and checkups, short- and long-term monitoring, personalized healthcare monitoring, incidence detection and management and emergency intervention, transportation and treatment.

From a more sociotechnical point of view, the terms *mobile health*, *connected health*, *IoMT*, *cloud health*, *health information* and *smart health* (e.g. [39][40][41][42][43][44]) seem also to relate to on-demand healthcare and underline its ubiquitous, ever-present, automatic and networking character. With a focus on the patient-centered aspect of on-demand healthcare, the term seems also to be related with *consumer healthcare* which allows patients to interact with systems and applications that enable patients to gather health information or co-create value, e.g. by exploiting the potentials of telemedicine or self-management tools (e.g. [45][46][47][48]).

Zooming out to non-IS literature, a few contributions approach the phenomenon from a technical or social perspective. For instance, Paul and Srinivasan [49] develop a logical services-enabling network architecture for on-demand healthcare and present different remote interaction modes between doctors and patients, i.e. text, voice and video transfer. The authors narrowly define on-demand healthcare as a setting, "where patients can connect and interact with doctors in real time". From a sociodemographic view, [50] displays the promises of on-demand *care* for different beneficiaries, i.e. patients, caregivers and family members. The authors define on-demand care broadly as "internet-based platforms and smartphone applications that enable consumers to obtain access to health services. On-demand health care ranges from instant access to physicians and other health providers to transportation options for people living with disabilities".

In contrast, there are several *practical* contributions that address the phenomenon of on-demand healthcare. Mostly, these contributions ascribe this term to the on-demand economy [51], in which healthcare is not only a lifestyle expression but also an important and fast-growing sector next to transportation and food [52][19]. In this context, the on-demand economy is closely connected to the sharing economy and implies the timely limited (and paid) access to resources instead of purchasing them [53][54]. Other practical contributions take a psychological perspective and refer to the concept of instant gratification after a transaction [55]. In the context of health, the immediate fulfilment of requests implies the likewise immediate treatment of certain injuries and illnesses [56], which entails several challenges regarding regulation [57] consumer expectations [53] or consumer rights [54]. Accordingly, healthcare service providers need to understand this ongoing shift to respond adequately. Especially, lack of relevant data and poor coordination among stakeholders in healthcare are seen as major barriers for digital progress and the provision of on-demand services [53].

As a result of analyzing the theoretical foundations, we could develop a working definition of on-demand healthcare to lay a foundation for the following two steps of the exploration phase:

"On-demand healthcare implies the immediate and convenient availability of and accessibility to healthcare services whenever a patient needs or requests it, preferably through the use of mobile devices. On-demand healthcare may apply to all digital-health related services such as gathering health information, finding healthcare service providers, scheduling appointments or receiving consultation."

3.3 *In-depth Interviews with Digital Health Experts*

Based on our theoretical findings, we conducted structured in-depth interviews with 14 international digital health experts at HPI-Mount Sinai Digital Health Forum 2019. We posed both closed and open questions to explore and analyze their understanding of on-demand healthcare. Most of the experts have yet heard of the term, but could not offer a concrete or distinct definition. However, most of them understood on-demand healthcare as a service which can be delivered in the very moment it is needed or requested. According to the experts, services imply indirect healthcare such as online information, appointments or orderings as well as direct healthcare such as consultation or council for the purpose of diagnosis or treatment. Some of the interviewees added technical (e.g. "mobile", "telemedicine"), temporal (e.g. "promptly", "when needed"), or spatial (e.g. "remote", "location-independent") constraints.

In order to elaborate these constraints, we explicitly asked for concrete time scopes and distinct technologies. The interviewees' responds define a time scope from one minute to one day, with a tendency to a couple of minutes. Some interviewees differentiate between (1) acute and negligible requests and (2) triage and further actions as decision criteria to evaluate urgency (and thus, immediacy). Among the mentioned concepts and technologies, telemedicine, EHR/ EPR, and mobile technologies (apps, smartphones, wearables) are the most prevalent ones. However, other terms mentioned are chat(bot)s, remote monitoring, search engines, video streams, online appointments, online information and symptom checkers, bandwidth and infrastructure, social media, or quantified self and biometric data.

Finally, we asked for advantages and disadvantages of on-demand healthcare and confronted the interviewees with our working definition to obtain feedback and proposals for adjustments. Among the advantages, the interviewees mostly stated efficiency, flexibility and convenience for the patients. Prompt service delivery has become a requirement of the modern consumer and this attitude increasingly spills over to the healthcare sector. Plus, a prompt medical or administrative aid can be vital in cases of emergency. From the supplier view, on-demand healthcare can render the hospital or clinic visit redundant, a digital triage can unburden the medical facilities and

therefore the entire health system. Among the disadvantages, the interviewees mainly stated issues of quality, data security, reliability and reimbursement of the healthcare service. With respect to our working definition, most of the interviewees complied with it or referred to their further statements. Some interviewees emphasized or recommended a focus on patient-centricity and time scopes as well as a generalization of technologies and services.

3.4 On-Demand Healthcare Applications

In a forth step and final step of our exploration phase, we identified and classified apparently typical on-demand healthcare services by means of a multiple-case study analysis in order to refine our understanding of on-demand healthcare and to derive standard types of on-demand healthcare services. At this, we draw on both available literature and empirical cases (i.e. records and websites from digital healthcare services) to identify a sufficient selection of appropriate cases with a preferably broad diversity regarding their respective value propositions. Mobile applications convey a sense of immediacy by nature. Some (esp. browser-based) applications require network access, others (esp. native ones) require access to hardware components (e.g. camera, sensors) or device functions (e.g. calendar), or data (entered data, storage data) to work properly. However, the usage of a mobile application does not automatically imply availability of or access to a healthcare-related service. Hence, we analyzed 16 mobile applications to derive and consolidate possible prerequisites of on-demand healthcare (see Table I).

Table I: Analysis of On-Demand Healthcare Services

<i>value proposition</i>	<i>example</i>	<i>resources</i>		
		<i>network</i>	<i>device</i>	<i>pers. data</i>
symptom check / diagnosis	ada, breazytrack	required	mostly required	required
self-management & control	BetterHelp, Vida, Apple	not necessarily	sometimes required	required
health information access	WikiMed	not necessarily	not necessarily	not necessarily
online pharmacy	myCare, PillPack	required	not necessarily	required
online appointment	doctolib, Jameda, Solv	required	mostly required	required
physician search and evaluation	Jameda	required	sometimes required	not necessarily
peer communication	Whatsapp, Facebook	required	sometimes required	required
online (video) consultation	Heal, Teladoc, HealthTap	required	required	required

Most of the applications require *mobile network access* (mainly LAN or WAN) in order to retrieve data from databases, which are either too rich for offline availability (e.g. symptom check database) or require real-time queries (e.g. online appointments) or communication (e.g. (video) chats). However, we found encyclopedias with offline functionality, which implies a big storage footprint but allows permanent availability regardless of network access. Moreover, many apps require *access to device resources*. For instance, symptom checkers or chats often need a camera functionality, while online appointment tools demand calendar access. Likewise, communication apps demand access to contacts and some self-management tools require access to specific sensors in a smartphone. Unsurprisingly, most app types also require *access to personal data* (either entered or collected from smartphone or wearable sensors). Symptom checkers and self-management tools need body-related data, while other apps require payment data (e.g. online pharmacies) or patient history data (e.g. online consultation) to improve their service quality. Network and data access seem almost vital in order to provide such ubiquitous and contextual services. Plus, the more immersive and high-value the service is (e.g. video consultation), the more resources are necessary on both sides.

4 Conceptualizing On-Demand Healthcare

On the basis of available academic and practical literature in the context of digital health as well as expert interviews and factual healthcare services, we explored and identified different facets of digital health to identify potential components of on-demand healthcare. We classified and aggregated these components into a conceptual framework of prerequisites, drivers and standard types of on-demand healthcare, and developed a proposal for a definition.

4.1 Prerequisites and Drivers

As one result of our analyses, we identified two main prerequisites of on-demand healthcare services. Especially the findings from the interviews and cases indicate that such services need to be always available and accessible whenever the patient needs them: This implies a *permanent and ubiquitous availability and access to both the services and their underlying infrastructure*. E.g. an application to check symptoms is useless without connectivity or database access and so is a tool for searching specialized physicians in the vicinity. Likewise, an application for online consultation is highly reliant upon a constant, secure and latency-free transmission of high-quality audio and video data.

Besides the prerequisites, we identified two driver types of on-demand healthcare. Drivers can generally be subdivided into digital drivers and social drivers. First, we present the identified *digital drivers*. The high prevalence and usage of *mobile or smart devices* (smartphones, wearables, smart objects) among both patients and healthcare professionals in conjunction with the ubiquity and availability of (preferably) wireless *internet connectivity* (with high bandwidth and low latency) has globally fostered the occurrence, acceptance and pervasion of digital services in general and, consequently, on-demand healthcare services in particular.

Additionally, sophisticated *sensors and actors (IoT/UC)* are able to capture various kinds and types of data. Advanced *data processing technologies*, such as data mining, big data, cloud/distributed computing and artificial intelligence enable a facilitated or even automated computation, management, transfer and analysis of such data for insights or decision support. These foundations pave the way for both simple and advanced *systems and applications*, which help patients to manage their health issues, such as websites, mobile apps, search engines, messengers, video streams, video chats, chatbots, or social media. Table II summarizes the identified digital drivers by the four distinct categories.

Table II: Digital Drivers of On-Demand Healthcare

<i>Driver</i>	<i>Explanation</i>
Communication technologies	The possibility to transfer health data and information with the existing technical infrastructure and necessary speed and bandwidth (e.g. WAN, LAN, PAN)
Data-processing technologies	The possibility to store, compute or analyze (huge amounts) of health data (e.g. Big Data, cloud/distributed computing, AI/ML)
Smart devices	The possibility of <i>physical</i> human-computer interaction to capture and exchange data and information (smartphones, PCs/laptops, wearables, smart objects)
Systems and applications	The possibility of <i>logical</i> human-computer interaction to capture and exchange data and information (e.g. mobile apps, websites, search engines, messengers, chats, streams, social media)

Next to digital drivers, we also identified *social drivers* as a result of our analysis which promote the occurrence of on-demand healthcare (see Table III). From a sociotechnical standpoint, increasing *technology acceptance* seems to be a crucial driver. Patients are more and more familiar with the usage and ubiquity of digital devices and applications and therefore, progressively expect and demand the availability of digital services. At the extreme, they actively exploit such applications to continuously trace and record medical and body-related data (*quantified self*).

Due to digital transformation, patients are spoilt with the *permanent and ubiquitous availability* of (digital and digitally enabled) services which progressively spills out to the healthcare market. Constant access to information about possible diseases or treatments leads to a (perceived) *health literacy* which is also triggered by an increased *health awareness* within the society. More information, however, can support *patient empowerment and involvement* with respect to diagnoses and treatments. Finally, *trust and privacy* issues are crucial for the *acceptance* of on-demand services.

Table III: Social Drivers of On-Demand Healthcare

<i>Driver</i>	<i>Explanation</i>
Quantified Self	The possibility to (automatically) capture, store and analyze personal or medical data
Patient Involvement	The possibility to actively take part in the process of treatment and decision-making
Permanent availability	The possibility to access services, products or information at any point in time
Ubiquitous availability	The possibility to access services, products or information from any place on earth
Health Awareness	The trend of taking care about the personal health and wellbeing
Health Literacy	The possibility to (technically) access and (cognitively) understand health information
Trust & Privacy	The trend of taking care about the legal use of own personal data by third parties
Technology Acceptance	The trend of accepting the ubiquity and usage of digital technologies

4.2 Standard Types and Characteristics

As another result of our analysis, we derived standard types and characteristics of on-demand healthcare services. The screening of mobile applications helped us to define standard types of such services. We classified these by their level of required patient involvement, resulting into three *standard types*: information, transaction, and interaction.

Services with low involvement include websites or apps, which help patients to instantly gather and consume *information* from any place at any time (e.g. search engines, blogs, magazines, encyclopedias like WikiMed). Other on-demand healthcare services reveal *transactional* elements and allow an instant and remote provision and payment of professional services, such as symptom checkers (e.g. ada health), online pharmacies (e.g. MyCare, PillPack), or online tools to fix appointments (e.g. doctolib), search and mediate healthcare providers (e.g. Solv), or rate physicians (e.g. jameda). A third group of healthcare services requires high involvement and *interaction*, such as forums for discussions with fellow patients (e.g. forums or social media groups on Facebook or Whatsapp) or the instant and remote provision of professional services through online consultation via text, calls or video chats (e.g. Heal, Teladoc, HealthTap).

Each service requires initial action from the patient (or automatically: from the patient's device) and a response from the service provider (or automatically: from the application). Hence, we also derived *service request and service delivery attributes* that help define on-demand healthcare services. Such services are always initiated by the patient as a result of a need or an arousal, i.e. they are *patient-driven* and *demand-based*. In turn, the service delivery has to be individual, contextual and personalized, i.e. *patient-related* and *demand-oriented*. Plus, the service requests happen *remotely*, i.e. bridging barriers in time and space, and *upon request*, i.e. only if the patient (or the device through the automatic analysis of sensor data) initiates the process. Hence, the service delivery also happens *remotely* and must occur as soon as possible, in the best case *immediately*. As we set digital health as the boundary of our consideration, such service requests are *digitally enabled* as they avail of modern ICT. Vice versa, the same applies to the service delivery.

4.3 On-Demand Healthcare: Framework and Definition

In this section, we conceptualize the findings from our analyses and contextualize them into a coherent framework of on-demand healthcare. On-demand healthcare services can be classified into three standard types (i.e. information, transaction, and interaction), which depend on their level of patient involvement, transmission bandwidth and service complexity. Plus, we identified five attributes each for service requests and deliveries of on-demand healthcare.

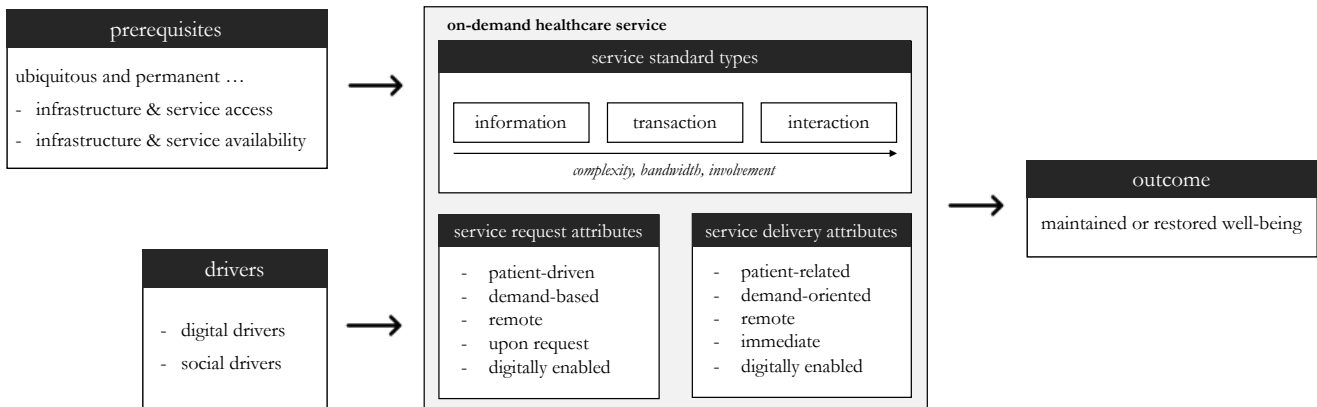


Figure 2: Conceptual Framework of On-Demand Healthcare

In order to successfully run and diffuse healthcare services on-demand, we identified necessary prerequisites (i.e. permanent and ubiquitous infrastructure and service access and availability) and two types of drivers (i.e. digital and social). Plus, we formulated the desired outcome of such interventions, namely the maintained or restored wellbeing of the patient or consumer. Figure 2 presents these artefacts by means of a conceptual framework of on-demand healthcare.

On this conceptual basis, we aim to propose a definition of on-demand healthcare. In a first step, we split the term into *on demand* and *healthcare*. According to Merriam-Webster, on demand means "when requested or needed" [58] and healthcare are "efforts made to maintain or restore physical, mental, or emotional well-being especially by trained and licensed professionals" [59]. Following practical literature about the "on-demand economy", the term is inextricably linked with digital services and consumer-driven [51][55] with a tendency of pervasiveness [18]. Bearing in mind the stated theoretical boundaries (e.g. [26][25]), digital technologies are an inherent condition of on-demand healthcare. In the light of these prerequisites and based on our analyses and framework, we propose the following generic definition of on-demand healthcare:

"On-demand healthcare is the request-based, patient-driven, immediate and remote provision of healthcare services by exploiting digital technologies in order to maintain or restore the physical, mental or emotional well-being."

Thus, on-demand healthcare is a subset of digital health and may – dependent on context – include concepts as telemedicine, online health-information, and mobile or connected health. All in all, the proposed definition in conjunction with the conceptual framework provides some groundwork and understanding of on-demand healthcare by boiling down its components and boundaries to an essence.

5 Conclusion and Outlook

The starting point of our consideration was to better understand and systematize the nature and concept of on-demand healthcare as there was virtually no theoretical foundation of this phenomenon so far, while practical contributions indicate its *raison d'être*. To address this research gap, we applied a mixed-methods approach and drew on the insights of available literature, expert interviews and empirical cases. The outcome of our paper is twofold: First we derived and developed prerequisites, drivers, standard types and characteristics of on-demand healthcare services in order to develop a conceptual framework. Second, we proposed a definition of on-demand healthcare on this theoretical and empirical basis.

For researchers in the field of digital health, our results can be a starting point and reference when exploring phenomena in the context of on-demand healthcare and substantiating the concept. We hope, our contribution adds another puzzle piece in understanding the complex field of digital health. For practitioners, our results can be used to systematically comprehend and develop such services. Future research could validate and expand the concept of on-demand healthcare, possibly from in-depth cases or patient studies. From a more holistic standpoint, further research is still required to systematically untangle the various and closely connected concepts in the entire context of digital health (e.g. mHealth, connected health, on-demand healthcare).

References

- [1] E. Böttinger and J. zu Putlitz, *Die Zukunft der Medizin*. Berlin: MWV, 2019.
- [2] K. Pousttchi, H. Schlieter, and A. Gleiß, Eds., *Digital Innovations in Healthcare - Digitale Innovationen im Gesundheitsmarkt*. Berlin: GITO, 2019.
- [3] H. Rivas and K. Wac, Eds., *Digital health: scaling healthcare to the world*. 2018.
- [4] L. F. Chu, A. G. Shah, D. Rouholiman, S. Riggare, and J. G. Gamble, "Patient-Centric Strategies in Digital Health.," in *Digital health: scaling healthcare to the world*, H. Rivas and K. Wac, Eds. Cham, Switzerland: Springer, 2018, pp. 43–54.
- [5] M. A. Pfannstiel, P. Da-Cruz, and H. Mehlich, Eds., *Impulse for healthcare - Impulse für die Versorgung*. Wiesbaden: Springer Gabler, 2017.
- [6] B. Bogdan, *MedRevolution: Neue Technologien am Puls der Patienten*. Berlin Heidelberg: Springer-Verlag, 2018.
- [7] K. Pousttchi and A. Gleiss, "Surrounded by middlemen - how multi-sided platforms change the insurance industry," *Electron Markets*, vol. 29, no. 4, pp. 609–629, Dec. 2019, doi: 10.1007/s12525-019-00363-w.
- [8] M. Kohlhagen, "GAFAM in healthcare: Aktivitäten von Google, Apple, Facebook, Amazon und Microsoft im Gesundheitsmarkt.," in *Digital Innovations in Healthcare - Digitale Innovationen im Gesundheitsmarkt*, K. Pousttchi, H. Schlieter, and A. Gleiss, Eds. Berlin: GITO, 2019, pp. 48–57.
- [9] M. Gersch and J. Liesenfeld, *AAL- und E-Health-Geschäftsmodelle: Technologie und Dienstleistungen im demografischen Wandel und in sich verändernden Wertschöpfungsarchitekturen*. Wiesbaden: Gabler Verlag, 2012.
- [10] R. G. Fichman, R. Kohli, and R. Krishnan, Eds., "Editorial Overview —The Role of Information Systems in Healthcare: Current Research and Future Trends," *Information Systems Research*, vol. 22, no. 3, pp. 419–428, Sep. 2011, doi: 10.1287/isre.1110.0382.
- [11] R. Agarwal, G. (Gordon) Gao, C. DesRoches, and A. K. Jha, "Research Commentary—The Digital Transformation of Healthcare: Current Status and the Road Ahead," *Information Systems Research*, vol. 21, no. 4, pp. 796–809, Dec. 2010, doi: 10.1287/isre.1100.0327.
- [12] N. Wickramasinghe and S. Kirn, "E-Health and the Future of Healthcare Information Systems," *Bus Inf Syst Eng*, vol. 5, no. 1, pp. 1–2, Feb. 2013, doi: 10.1007/s12599-012-0245-1.
- [13] P. Constantinides and M. Barrett, "Information Infrastructure Development and Governance as Collective Action," *Information Systems Research*, vol. 26, no. 1, pp. 40–56, Mar. 2015, doi: 10.1287/isre.2014.0542.
- [14] S. Dünnebeil, A. Sunyaev, J. M. Leimeister, and H. Krmar, "Modulare Softwarearchitektur für Mehrwertanwendungen der deutschen Gesundheitstelematik," *Wirtschaftsinf*, vol. 55, no. 1, pp. 3–18, Feb. 2013, doi: 10.1007/s11576-012-0345-z.
- [15] R. M. Kolodner, S. P. Cohn, and C. P. Friedman, "Health Information Technology: Strategic Initiatives, Real Progress: There is nothing 'magical' about the strategic thinking behind health IT adoption in the United States.," *Health Affairs*, vol. 27, no. Suppl1, pp. w391–w395, Jan. 2008, doi: 10.1377/hlthaff.27.5.w391.
- [16] K. Pousttchi, A. Gleiss, B. Buzzi, and M. Kohlhagen, "Technology Impact Types for Digital Transformation," in *2019 IEEE 21st Conference on Business Informatics (CBI)*, Moscow, Russia, Jul. 2019, pp. 487–494, doi: 10.1109/CBI.2019.00063.
- [17] K. Pousttchi, "Digital Transformation," *Encyclopedia of Business Informatics*. GITO, Berlin, Germany, 2017, [Online]. Available: <https://www.enzyklopaedie-der-wirtschaftsinformatik.de/lexikon/technologien-methoden/Informatik--Grundlagen/digitalisierung/digitale-transformation/digitale-transformation>.
- [18] U. Varshney, "Pervasive Healthcare: Applications, Challenges And Wireless Solutions," *CAIS*, vol. 16, 2005, doi: 10.17705/1CAIS.01603.
- [19] D. Boston and M. Kovach, "Healthcare For Here or To Go?," *Accenture Consulting*, White Paper. [Online]. Available: <https://www.accenture.com/us-en/insight-healthcare-here-to-go>.
- [20] S. Gregor, "The Nature of Theory in Information Systems," *MIS Quarterly*, vol. 30, no. 3, pp. 611–642, 2006, doi: 10.2307/25148742.
- [21] A. R. Hevner, S. T. March, Y. Park, and S. Ram, "Design Science in Information Systems Research," *MIS Quarterly*, vol. 28, no. 1, pp. 75–105, 2004, doi: 10.2307/25148625.
- [22] Hevner, March, Park, and Ram, "Design Science in Information Systems Research," *MIS Quarterly*, vol. 28, no. 1, pp. 75–105, 2004, doi: 10.2307/25148625.
- [23] W. Kuechler and V. Vaishnavi, "A Framework for Theory Development in Design Science Research: Multiple Perspectives," *Journal of the Association for Information Systems*, vol. 13, no. 6, pp. 395–423, 2012.

- [24] S. T. March and V. C. Storey, "Design Science in the Information Systems Discipline: An Introduction to the Special Issue on Design Science Research," *MIS Quarterly*, vol. 32, no. 4, pp. 725–730, 2008, doi: 10.2307/25148869.
- [25] H. Oh, C. Rizo, M. Enkin, A. Jadad, J. Powell, and C. Pagliari, "What Is eHealth (3): A Systematic Review of Published Definitions," *J Med Internet Res*, vol. 7, no. 1, p. v7i1e1, Feb. 2005, doi: 10.2196/jmir.7.1.e1.
- [26] M. Gersch and L. Wessel, "E-Health & Health-IT," *Encyclopedia of Business Informatics*. GITO, Berlin, 2019, [Online]. Available: <https://www.enzyklopaedie-der-wirtschaftsinformatik.de/wi-enzyklopaedie/lexikon/informationssysteme/Sektorspezifische-Anwendungssysteme/Gesundheitswesen--Anwendungssysteme-im/e-health-und-health-it/e-health-und-health-it/>.
- [27] F. Rowe, "What literature review is not: diversity, boundaries and recommendations," *European Journal of Information Systems*, vol. 23, no. 3, pp. 241–255, May 2014, doi: 10.1057/ejis.2014.7.
- [28] H. M. Cooper, "Organizing knowledge syntheses: A taxonomy of literature reviews," *Knowledge in Society*, vol. 1, no. 1, pp. 104–126, Mar. 1988, doi: 10.1007/BF03177550.
- [29] G. Schryen, "Writing Qualitative IS Literature Reviews—Guidelines for Synthesis, Interpretation, and Guidance of Research," *CAIS*, vol. 37, no. 1, pp. 286–325, 2015, doi: 10.17705/1CAIS.03712.
- [30] J. Collis and R. Hussey, *Business research: a practical guide for undergraduate & postgraduate students*, Fourth edition. Houndmills, Basingstoke, Hampshire ; New York, NY: Palgrave Macmillan, 2014.
- [31] R. K. Yin, *Case study research: design and methods*, 4th ed. Los Angeles, CA: Sage Publications, 2009.
- [32] I. Benbasat, D. K. Goldstein, and M. Mead, "The Case Research Strategy in Studies of Information Systems," *MIS Quarterly*, vol. 11, no. 3, pp. 369–386, 1987, doi: 10.2307/248684.
- [33] L. Menvielle, A.-F. Audrain-Pontevia, and W. Menvielle, *The Digitization of Healthcare: New Challenges and Opportunities*. Springer, 2017.
- [34] M. Gelinsky, "3D Printing," in *Digital health: scaling healthcare to the world*, H. Rivas and K. Wac, Eds. 2018, pp. 109–122.
- [35] I. Bardhan, J. (Cath) Oh, Z. (Eric) Zheng, and K. Kirksey, "Predictive Analytics for Readmission of Patients with Congestive Heart Failure," *Information Systems Research*, vol. 26, no. 1, pp. 19–39, Mar. 2015, doi: 10.1287/isre.2014.0553.
- [36] M. Aspria, M. de Mul, S. Adams, and R. Bal, "Integrating Users in an Interactive Video Education Project: Reframing the Patient-Centered Strategy of a Cystic Fibrosis Centre," *CAIS*, vol. 34, 2014, doi: 10.17705/1CAIS.03423.
- [37] J. K. Zao et al., "Custos Remote on-demand healthcare aided with wireless sensors and mobile phones," in *2008 IEEE International Conference on Systems, Man and Cybernetics*, Singapore, Oct. 2008, pp. 2264–2269, doi: 10.1109/ICSMC.2008.4811630.
- [38] T.-W. Shen, F.-C. Liu, and W. S.-T. Chen, "Developing non-parametric density estimation on genetic evolution computing as a cloud based sensor fusion method: Taking psychiatric major depressive disorder detection as an application example," in *2013 Seventh International Conference on Sensing Technology (ICST)*, Wellington, New Zealand, Dec. 2013, pp. 56–61, doi: 10.1109/ICST.2013.6727616.
- [39] U. Gerhardt, R. Breitschwerdt, and O. Thomas, "mHealth Engineering: A Technology Review," *JITTA*, vol. 19, no. 3, pp. 82–117, 2018.
- [40] S. Motamarri, S. Akter, P. Ray, and C.-L. Tseng, "Distinguishing 'mHealth' from Other Healthcare Services in a Developing Country: A Study from the Service Quality Perspective," *CAIS*, vol. 34, pp. 669–692, 2014, doi: 10.17705/1CAIS.03434.
- [41] H. Cripps, C. Standing, and V. Prijatelj, "Smart Health Care Cards: Are they applicable in the Australian context?," in *BLED 2012 Proceedings*, Bled, Slovakia, 2012.
- [42] P. Howell, M. Abdelhamid, R. Sharman, and S. D. Smith, "Smart Card Adoption in Healthcare: An Experimental Survey Design using Message Framing," in *ICIS 2016 Proceedings*, Dublin, Ireland, 2016.
- [43] A. Bajracharya, K. Reader, and S. Erban, "User Experience, IoMT, and Healthcare," *THCI*, vol. 11, no. 4, pp. 264–273, Dec. 2019, doi: 10.17705/1thci.00125.
- [44] N. Rozenkranz, A. Eckhardt, M. Kühne, and C. Rosenkranz, "Health Information on the Internet: State of the Art and Analysis," *Bus Inf Syst Eng*, vol. 5, no. 4, pp. 259–274, Aug. 2013, doi: 10.1007/s12599-013-0274-4.
- [45] A. Sunyaev, "Consumer Facing Health Care Systems," *e-Service Journal*, vol. 9, no. 2, p. 1, 2014, doi: 10.2979/eservicej.9.2.1.
- [46] S. A. Sherer, "Patients Are Not Simply Health IT Users or Consumers: The Case for 'e Healthcant' Applications," *CAIS*, vol. 34, pp. 351–364, 2014, doi: 10.17705/1CAIS.03417.
- [47] E. V. Wilson, *Patient-Centered E-Health*. Hershey, PA: Information Science Reference, IGI Global, 2009.
- [48] G. Miscione, "Telemedicine in the Upper Amazon: Interplay with Local Health Care Practices," *MIS Quarterly*, vol. 31, no. 2, p. 403, 2007, doi: 10.2307/25148797.
- [49] S. Paul and K. Srinivasan, "On-Demand Health care: A new paradigm for E-Health," in *2009 11th International Conference on e-Health Networking, Applications and Services (Healthcom)*, Sydney, Australia, Dec. 2009, pp. 153–160, doi: 10.1109/HEALTH.2009.5406209.
- [50] W. D. Dawson, "The Future is Now? On-Demand Health for Long-Term Services and Supports," *Public Policy & Aging Report*, vol. 27, no. 3, pp. 106–110, 2017, doi: 10.1093/ppar/prx018.
- [51] C. Colby and K. Bell, "The on-demand economy is growing, and not just for the young and wealthy," *HBR*, 2016, [Online]. Available: <https://hbr.org/2016/04/the-on-demand-economy-is-growing-and-not-just-for-the-young-and-wealthy>.
- [52] M. McDonald, "On-demand is in demand: Experience lifestyle commerce," *Accenture Strategy*, White Paper, 2015.
- [53] P. Nota, "Does healthcare understand the 'on demand' consumer?," Philips, 2016. <https://www.philips.com/a-w/about/news/archive/blogs/innovation-matters/does-healthcare-understand-the-on-demand-consumer.html> (accessed Mar. 15, 2020).
- [54] F. Natour, "Respecting Human Rights in the On-Demand Economy: Closing the New Governance Gap," *Bus. and hum. rights j.*, vol. 1, no. 2, pp. 315–320, Jul. 2016, doi: 10.1017/bhj.2016.7.
- [55] J. Hanson, "What is the On-demand Economy?," *PubNub*, 2019. <https://www.pubnub.com/blog/what-is-the-on-demand-economy/>.
- [56] "The Rise of On-Demand Healthcare," *JungleWorks*, Apr. 26, 2017. <https://jungleworks.com/the-rise-of-on-demand-healthcare/> (accessed Mar. 15, 2020).
- [57] "On-demand Health Care Is as Easy as Ordering a Pizza | AHA," *American Hospital Association*. <https://www.aha.org/aha-center-health-innovation-market-scan/2019-03-04-demand-health-care-easy-ordering-pizza> (accessed Mar. 07, 2020).
- [58] "Definition of ON DEMAND," *Merriam-Webster*. Springfield, MA, 2020, Accessed: Mar. 15, 2020. [Online]. Available: <https://www.merriam-webster.com/dictionary/on+demand>.
- [59] "Definition of HEALTHCARE," *Merriam-Webster*. Springfield, MA, 2020, Accessed: Mar. 15, 2020. [Online]. Available: <https://www.merriam-webster.com/dictionary/healthcare>.