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Building Understanding of Experience Design in Digital Health: Preliminary Results Based on Semi-Structured Interviews



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Abstract Design is expanding its influence on shaping future healthcare. Ideally, designers apply human-centered design and human factors that introduce theory, principles, and methods to design to optimize people's healthcare experiences in both digital and non-digital environments. To discuss and implement experience design in healthcare, consensus about experience design in healthcare is needed. Objectives: Therefore, the purpose of this study is to investigate designers' views on experience design in health, and to uncover their understanding about three experience design concepts, i.e., user experience (UX), patient experience (PEx), and digital patient experience (dPEx). We conducted online semi-structured interviews study with convenience samples who met the eligibility. We used ATLAS.ti for an in-depth data coding following thematic analysis. 24 international designers of digital health solutions, either in industry or in academia took part in the interviews. We found the similarities and differences mentioned between healthcare design and non-healthcare design relate to (1) design principles, (2) user attributes, and (3) design contexts. Furthermore, the differences between UX, PEx, and dPEx can be mapped on five dimensions: people, contexts, purposes, means, and usage scenarios. These insights can help designers and human factors specialists build a common design language for experience design in healthcare. Our study can also assist designers and human factors specialists with experience design in digital health by pointing out the areas where design thinking generally is appropriate and the places where particular expertise in healthcare design is needed.

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1 Background

Design is expanding its influence on shaping future healthcare (Groeneveld et al. 2018; Tseklevs and Cooper 2017). For instance, designers are promoting the use of digital technologies and medical equipment in care domains by working at the interface between people and technology (Groeneveld et al. 2018). As the focus of healthcare shifts from disease toward patient experience (Ekman et al. 2011), experience design has become a crucial part of healthcare design for creating an efficient healthcare system and improving care quality (Lee 2019). Designing experience in healthcare brings together a variety of disciplines and stakeholders, which requires aligning the goals of organizations, technology, and people in the real world. Ideally, designers apply human-centered design (Bazzano et al. 2017) and human factors (Cafazzo and St-Cyr 2012) that introduce theory, principles, and methods to design to optimize people's healthcare experience, in both digital and non-digital health sectors.

Experience is generally defined as what a person thinks, feels, and says about the experience of a service, process or product the person has encountered (Bate and Robert 2006). Design is emerging as an influential field in understanding experiences of these situations and how they can be improved (Jones 2013). Experience design starts by clarifying the needs and emotions involved in an activity. It then shapes the functionality that can deliver the experience and finds an appropriate way of making the functionality into action (Cafazzo and St-Cyr 2012). In the field of healthcare, individuals may play the roles of consumers or patients, and their interpretations of the term "experience" can vary (Castle-Clarke and Imison 2016). Similar to this, designers could have different perspectives on "design experience for patients". Design can impact or promote "experience", but without agreement on a common design language (Jones 2013), the designed outcomes may not be successfully ingrained in reality. Furthermore, as digital technology becomes ubiquitous in healthcare, which adds another dimension to the complex healthcare design (Jones 2013). Given how easily it can be misunderstood in the context of healthcare, it is crucial to clarify what experience means at the very beginning.

In healthcare design practice, patient experience is one of the widely used experience concepts. It is defined by The Beryl Institute as the sum of all interactions, shaped by an organization's culture, that influence patient perceptions, across the continuum of care (Institute et al. 2021). Besides, user experience is often used when talking about the design of digital health. In the current study, we define it as a person's perceptions and responses that result from the use and/or anticipated use of a product, system or service (Bolton 2018; Jokela, et al. 2003). In keeping with our earlier research (Wang et al. 2022), which investigated the concept of digital patient experience (dPEX) and defined it as the sum of all interactions affected by

a patient's behavioral determinants, framed by digital technologies, and shaped by organizational culture, that influence patient perceptions across the continuum of care channeling digital health. Therefore, in this study, we aim to (1) investigate designers' views on experience design in health, and (2) uncover their understanding about three core concepts, i.e., user experience (UX), patient experience (PEx), and digital patient experience (dPEx).

2 Methodology

We conducted a semi-structured interview study with purposive sampling (Etikan et al. 2016) until the saturation threshold was achieved (Fusch and Ness 2015). The study was approved by the Human Research Ethics Committee of Delft University of Technology in September 2021.

2.1 Participants Recruitment

Using snowballing recruiting method (Streeton et al. 2004), designers were recruited between November and December 2021. The inclusion criteria of interviewees were proposed by TW and adjusted by GG, MM, and RG as follows:

- Currently working in industry or academia
- Involving in at least one digital health design-related project
- English or Chinese speakers.

Participants were asked to think back on an impressive digital health-related design project they had been involved in and share the project information (if applicable) in advance with the interviewer (TW), for example, project name, description, or relevant link.

2.2 Interview Procedure

An outline with semi-structured questions was developed to obtain the overall experiences and views of designers in relation to how the digital patient experience was addressed in their design process. Each interview lasted between 1–2 h and was conducted in English or Chinese using online meeting software. The interview consisted of 4 phases:

- Phase 1: warm up conversations
- Phase 2: introduction of interviewees about their background and work experience
- Phase 3: diving into the main theme of dPEx

- Phase 4: closing questions.

Following the interview, a follow-up questionnaire with two close-ended questions was administered to understand designers' priorities in regards to previously identified influencing factors and evaluation metrics (Wang et al. 2022).

2.3 Data Extraction and Thematic Analysis

Audio-recordings were transcribed and deidentified to prepare for analysis. Anonymized transcriptions were imported into ATLAS.ti (Scientific Software Development GmbH; Version 22.1.0; 3475) for data analysis. Data were extracted from the following aspects: (1) participants' characteristics, including gender, major, year of graduation, job title, work domains, work years, numbers of digital health projects involved, company type, company size, and work location; (2) characteristics of digital health design-related projects, such as design contexts, target users; (3) views of healthcare design and understandings of experience concepts in healthcare; (4) the typical workflow of digital health design; (5) influencing factors of dPEX; (6) evaluation metrics of digital PEX; (7) good dPEX's elements; (8) healthcare design challenges; and (9) healthcare design knowledge building. Considering the research objectives of the current study and the limited writing space, in this paper, we only present the findings of the first three aspects mentioned above as the preliminary results of the current study. The remaining results will be presented in another parallel publication.

We used Braun and Clarke's six-phase thematic analysis method (Braun and Clarke 2006) to analyse the extracted data. After becoming familiar with the data, an initial coding scheme was generated by TW. Three coders were involved in the entire iterative coding process (TW, QS, and HZ). Three transcriptions were used by TW, QS, and HZ as initial samples to test the coding scheme, followed by a group discussion to deal with any discrepancies about the codes. When coders reached an agreement, the remaining 21 transcriptions were randomly divided, and each coder coded 7 transcriptions independently. The whole coding process followed a few coding techniques: (1) Generate codes as close to the original texts as possible; (2) Use clear structures (e.g., verb phrases, noun phrases) to formulate the codes; (3) Simplify and clarify the codes; (4) Minimize the number of codes; (5) Use English codes to code Chinese texts; and (6) Highlight uncertain codes for later group discussions.

3 Results

3.1 Participant Characteristics

A total of 24 digital health designers were interviewed, which covered a diverse set of backgrounds and healthcare design practices. Of them, 18 (75%) were female designers. Most participants ($n = 20/83\%$) hold master's degrees, while

two individuals ($n = 2/8.5\%$) hold bachelor's and two individuals ($n = 2/8.5\%$) hold doctoral degrees. They graduated from 2005 to 2020. Their years of working experience ranged from 1 to more than 16 years, with 5.5 years being the average. They are employed as (industrial, UX, service, interaction, or strategic) designers; design researchers; design leads; engineers; advisors; managers; or founders. As of company size, 8 (33.3%) of them work for small businesses (less than 50 employees), 4 (16.7%) work for medium businesses (50–200 employees), 10 (41.7%) of them work for large corporations (over 200 employees), and 2 (8.3%) work in academia. These companies, which are in the Netherlands, China, the United States, the United Kingdoms, Canada, Sweden, Norway, or Spain, are involved in design agencies, hospitals and healthcare, electronic manufacturing, medical equipment, internet-related sectors, consultant agencies, or universities.

3.2 *Project Characteristics*

During the interview, each participant was asked to share one of their most impressive digital health-related projects. Most of these projects ($n = 20/83.3\%$) were professional projects; the remaining projects ($n = 4/16.7\%$) belonged to master students. We categorized these projects into the following three types:

- Interaction design: the design of interfaces, websites, and mobile applications ($n = 17/71\%$).

“To develop a mobile app that can be used to conveniently explain the use of the device for people who are having migraine. And that can be also used to survey these people, people about their experience throughout the treatment.” [P2].

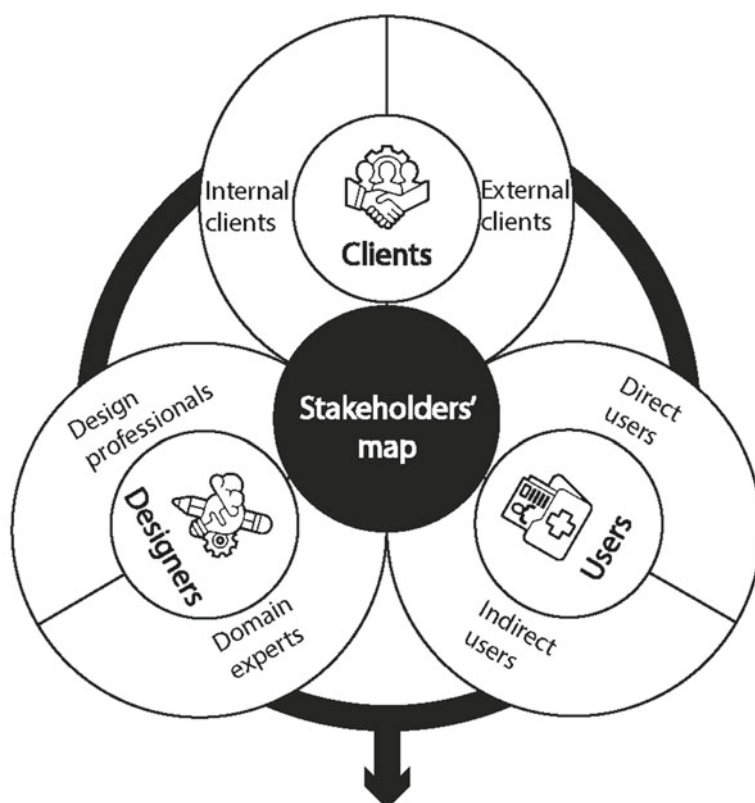
- Strategic design: the design of new care models, patient journeys, innovative roadmaps, care centres or departments ($n = 9/37.5\%$).

“To help them to translate all these ideas or these visions, or all these ways in which they thought about the future of health, get to bring that together and connect this knowledge to facilities management to the people were eventually gonna design the look.” [P20].

- Product design: the design of industrial medical products or wearable devices ($n = 3/12.5\%$).

“We developed a screening and monitoring device, which is used to diagnose patients with respiratory disease and asthma problems”. [P14].

Among the reported projects, there were three distinct stakeholder groups mentioned to be involved in the design process (see Fig. 1). Notably, not all stakeholders were involved in each project.



The related hospitals, companies, communities, and public sectors

Fig. 1 Stakeholders' map of healthcare design

- **Clients**

Internal and external business customers who initiate a design proposal. Half of the reported projects ($n = 12/50\%$) were initiated by external clients, such as hospitals or third parties, and the rest ($n = 12/50\%$) were self-developed.

“When I joined, the one of my first projects... is a remote based monitoring solution for episodic care...” [P9].

- **Designers**

Design professionals (e.g., managers, designers, engineers, and programmers) and domain experts (e.g., medical experts, policy experts, business experts, and patient representatives) who work on the design project. Most professional projects are processed by big design teams that have both design professionals and domain experts. However, rather than having a real team, participants in the student projects

claimed that there were people (such as supervisors, physicians, or patients) who were assisting them.

“We’ve got so many more designers and developers and managers and executives, so that there’s always a bigger team.” [P22].

- Users

Direct and indirect users who contribute to testing design outcomes and are the sources of healthcare needs. Most participants work directly with patients or conduct observations. While when it comes to the vulnerability and privacy concerns of the target patient groups, designers frequently receive information on patients (i.e., direct users) from doctors or nurses (i.e., indirect users).

“I had a lot of help from the care staff to understand what was happening from dementia point of view. But on the other hand, the family members were knowing their parents from the past like...” [P22].

Besides, many participants mentioned the hospitals, companies, communities, as well as public sectors to have an impact on the entire design process as well. Considering the health issues, the majority of initiatives ($n = 15/62\%$) were centred on chronic illnesses, including diabetes, migraine, sleep problems, insomnia, high blood pressure, kidney cancer, breast cancer, stroke, cognitive impairments, psychological therapy, and multiple sclerosis, and followed by acute illnesses ($n = 4/17\%$, orthopaedic surgery, COVID-19, asthma, post-surgery), and other ($n = 5/21\%$, pregnancy, general health difficulties).

3.3 *Design in Health*

Regarding differences and similarities between designing for patients and designing for healthy people there was a clear division in opinions among the participants: some ($n = 13/54\%$) argued there is a big difference, while others ($n = 11/46\%$) believed that design for patients and design for healthy people is the same. We found the similarities and differences mentioned between healthcare design and non-healthcare design relate to (1) design principles, (2) user attributes, and (3) design contexts (see Table 1).

- Design principles

More than half of the participants think there is no difference between designing for patients and for healthy people because they share the same design process and methods. However, other participants argued that the biggest focus of healthcare design is curing patients, while the objective of non-healthcare design is making

Table 1 Differences and similarities between healthcare design and non-healthcare design

Categories	Themes	Same (✓) or different (x)	Quotes
Design principles	Design process	✓	P1: I wouldn't say that the process would be different, because there are a lot of situations or topics that can be sensitive, not only if you're ill. So no, I would say there's no difference
	Design methods	✓	P18: Design principles, methods and empathy are the same in each domain
	Design value	x	P13: Experience and comfort come as fasting when you're designed for healthy people, because the people are already healthy. So, it's basically making their lives a little bit easier. And for patients, the biggest focus is saving them. So, it's basically making it comfortable on saving the patients. Two objectives
	Design requirements	x	P2: But, in general, for designing for the medical field...you have to make sure your quality management throughout the development process is well built up and well documented. Because in the medical fields, you always have to prove the things work... and you have to test and show that you made the best decisions. So that's very different
User attributes	Health status	✓	P12: Design solution based on different scenarios, not between healthy or unhealthy status
		x	P3: I try to think about patients in the context of their lives that they are not their diseases, they are not their conditions...But I also don't want to lose sight of the fact that they do have extreme circumstances that need to be accounted for
	Health needs	✓	P7: Patient and general user are somehow the same because sometimes they don't know their real need
		x	P10: patients and healthy people have different expectations, patients want to be normal, but healthy people want to be better than normal life
	Engagement	x	P20: Maybe there is one big difference that I've seen. It's the amount of engagement people have with their own care data, right? Someone is sick. They will be more motivated to do measurements

(continued)

Table 1 (continued)

Categories	Themes	Same (✓) or different (x)	Quotes
	Multi-users	x	P6: User experience includes different users such as patients, maintenance staff and other users in the whole service blueprint
Design contexts	Restriction of regulations	x	P18: The real differences arise from social regulations and prevailing thoughts in the field of healthcare
	Complexity of scenarios	x	P5: All these things that you don't really have to think of when you're designing consumer products, because you assume anyone has a phone. When you think of products within healthcare, it becomes a lot trickier because then you have to think of the context of use like if they're in the patient house, if they're in the hospital... And so that's a huge issue
	Maturity of industry	x	P8: And the reason that I went into healthcare also because I see that there is so much that still needs to be done if you compared to commercial market
	Sensitivity of data	x	P7: But the most significant difference is the patient privacy is more protected. Or general, you ask users I want to design a coffee machine for you, what kind of coffee do you like and spend one or two hours talking about their expectation for having coffee. But if you ask cancer patient that what's your expectations on the patient bed in the hospital, they may not be open to share everything... Also, the ethical issue should be taken more into consideration...

users' normal lives a little bit better. The healthcare field requires much more evidence-based design than in other domains.

- User attributes

Some participants believe that patients' health status is different from that of healthy individuals, which has unexpected consequences that even patients themselves may not be aware of. However, others argue that a healthy individual can sometimes be a patient with ups and downs in daily life while a patient also has daily life needs just like a healthy person. As a result, there aren't many differences in designing for healthy and sick people. Additionally, some participants believe that expectations between ill and healthy persons are different. Patients desire a healthy and normal life, whereas healthy individuals want to be better than normal. Others counter that because sometimes no one is aware of their true needs, ill and healthy people are

somehow similar. The majority of participants concur that sick individuals will be more inclined to adopt and actively participate in design solutions. Additionally, they concur that there are additional users and stakeholders need to consider during the design flow of healthcare design projects.

- Design contexts

Another category is about design context. Most participants think that the design context is more complex in the healthcare domain than in the non-healthcare domain. In the healthcare industry, the regulations are more restrictive, the usage scenarios are more complicated, the business models are underdeveloped, and data collection and storage are more sensitive.

3.4 *Experience Design in Digital Health*

Participants provided a range of responses when asked how they perceived user experience (UX), patient experience (PEX), and digital patient experience (dPEX). Notably, even though we did not always use the term “digital health”, given the participants’ professional backgrounds and the study’s main objective, the conversation was consistently about designing for digital health.

The differences between UX, PEX, and dPEX were mapped on five dimensions: people, contexts, purposes, means, and usage scenarios (see Table 2). They concerned with the interactions among humans and other elements of the digital health system.

- Between “specific” and “general” people: in contrast to PEX, which exclusively focuses on patients, UX is more general because it takes into account everyone involved in the entire service plan. Both of them refer to human-centered design, the former focuses on patient-centered design, the later relate to user-centered design.
- Between “continuous” and “momentary” contexts: (digital) PEX is considerably more continuous and permeates patients’ everyday life than UX, which is more concerned with momentary touchpoints. This dimension indicates human–computer interactions have longer impact on (digital) PEX than general UX.
- Between “emotional” and “functional” purposes: (digital) PEX is far more emotionally loaded and is more influenced by patient specific situation than UX. The former focuses more on patients’ well-being, it is substantially more complex, intangible, and challenging to measure than the latter, which focuses more on overall system performance and can be evaluated using a usability test.
- Between “digital” and “hybrid” means: dPEX is the digital way of the PEX. It highlights human-technology relationships than general PEX in healthcare context. Notably, the design of digital health and non-digital health is not a binary opposition. To some extent, participants reported that dPEX should be incorporated into the offline experience as well.

Table 2 Understandings of three experience concepts (UX, PEx, and dPEx) in healthcare design

Dimensions	Tensions	Experience concepts	Quotes
People	Specific	PEx (n = 3)	P5: When you think of the PEx... it might be too specific to not allow you to think of the other players, which are like caregivers, the community nurses
	General	UX (n = 4), PEx (n = 1)	P8: UX is broader. So, normally, we don't only look at the PEx but we also look at the caregiver's experience
Contexts	Momentary	UX (n = 4), dPEx (n = 1)	P1: I think with UX it's maybe not that emotionally loaded or like that's important. So, if I don't know where I can press a button, I won't worry about it anymore tomorrow
	Continuous	PEx (n = 8), dPEx (n = 4)	P1: I think the PEx is not only the contact with the hospital but also how we get support from experts. And I would say that the dPEx will be the same, but then only in the digital way. I think that's more continuous because it's always there
Purposes	Functional	UX (n = 4)	P3: What I see more often is situations where UX designers are being brought in, and they're being prescribed a problem. And they're going in and they're understanding it from the lens of that problem
	Emotional	PEx (n = 3), dPEx (n = 3)	P1: A PEx, in that case, is more the effects of the information you get from the digital eHealth so if you feel supported
Means	Digital	dPEx (n = 9)	P17: I see the dPEx as like a tool within that (PEx). I see the dPEx more in like, how is the application used as a tool to accommodate or solve for certain needs that the patient has in their journey

(continued)

Table 2 (continued)

Dimensions	Tensions	Experience concepts	Quotes
Usage scenarios	Hybrid	PEx (n = 2)	P15: PEx is the integration of online and offline experiences. dPEx should be more convenient and should be incorporated into the offline experience
	Concrete	dPEx (n = 2)	P19: ...just that the dPEx, ...I think that its purpose or its use scenario is more targeted and clearer
	Vague	UX (n = 1)	P17: It (UX) kind of forgets about the context in which the application is being used, because there are certain standards that make certain applications user-friendly or usable, and others not

- Between “concrete” and “vague” usage scenarios: the usage scenario of dPEx is clearer than UX, as the latter disregards the context in which the application is being used.

4 Discussion

Our findings show that Designers’ background and their involved projects were diverse. In a professional project, designers typically only handle a portion of the entire design process. A concrete design output is required based on commercial and implementational considerations. However, in a student project, the design output is more flexible and creative. This finding is align with a previous study, which indicates that academic innovation projects focus on feasibility, whereas industry-driven projects focus on viability (Boissy 2020). Most projects involved varied stakeholders in the design process, including internal and external clients, domain experts, design professionals, indirect and direct users. We discovered that some projects are made for multiple end users, such as patients and healthcare professionals, while others are made for only one kind of end user, such as a particular patient group. Projects with multiple end users typically require extra efforts to balance the needs of different users. In terms of user research, designers in some projects investigated both direct and indirect users to gain a deeper understanding of the design context. However, due to a lack of research resources in some projects, designers only looked into either direct or indirect users. Sometimes, designers tended to understand patients by asking health professionals. According to prior research (Jones 2013; Carr et al. 2011), a product or service could, however, be mistakenly developed for an ideal user group, ignoring other players it may affect. This highlights the importance of involving all

stakeholders thoroughly in the design process. Besides, care providers mediating the contact between care recipients and designers can be a challenge (Groeneveld et al. 2018), since healthcare professionals may be unfamiliar with the role of design in health (Wildevuur 2017), and the expectations of care professionals with regard to design may be different from patients.

The design methods and processes used in healthcare design are the same as those used in design for non-healthcare domains, such as the double diamond design process, but the design values and requirements are different. Our study indicates that it is possible to examine the role that design plays in healthcare via the prism of design in other fields, which aligns with the previous study (Tsekleves and Cooper 2017). As Bate and Robert stated that “good design” of healthcare services—and the resulting “good experience”—is essentially no different from good design in any sector, including performance (functionality), engineering (safety), and the aesthetics of experience (usability) (Bate and Robert 2006). However, Jones argued that conventional user-centred design practices are insufficient to solve problems considering the complexity in healthcare (Jones 2013) which our findings seem to support. Considering the vulnerable target users and complex design contexts, healthcare designers are facing more challenges. Regarding the functionality, safety, and usability of digital health systems, more rigorous evidence-based and human factors design considerations are needed. What’s more, experience is designated as “how well people understand it, how they feel about it while they are using it, how well it serves its purpose, and how well it fits into the context in which they are using it” (Bate and Robert 2007). Different focuses and approaches serve slightly different experiences. Our study surfaced five dimensions, which are people, contexts, purposes, means, and usage scenarios, to understand experience design in digital health. The five dimensions show that experience design in digital health can be shaped by “specific” or “general” user groups, influenced by “continuous” or “momentary” interaction contexts, served for “emotional” or “functional” design purposes, addressed through “digital” or “hybrid” delivery means, and targeted at “concrete” or “vague” usage scenarios. Therefore, during the design collaborations for a better healthcare experience, clear communication among the five dimensions is necessary. For example, a human-centered (patient- or user-centered) design approach should be considered in the beginning of design regarding the target user groups. A consideration of people’s daily lives and emotional support is required for the design of a better (digital) PEx. In contrast to (digital) PEx, UX design concerns more problem-solving techniques and usability tests. The selection of digital or non-digital design solutions should be based on the needs at hand, since designing for digital health and non-digital health is not a binary opposition. In other words, the design considerations of dPEx should be incorporated into non-digital PEx as well. As Marc Hassenzahl (Cafazzo and St-Cyr 2012) said, while experience is intangible, volatile, an interactive product is tangible, a mass-produced piece of technology. The way we design experience in healthcare determinates how people will experience it.

Limitations: First, as a qualitative study, it is hard to collect data with a large sample size. However, we recruited a diverse group of participants, which helped

us collect rich in-depth data. Second, the participants' and projects' characteristics varied widely among the interviews, limiting meaningful comparisons between different designers and projects.

5 Conclusions

We found the similarities and differences mentioned between healthcare design and non-healthcare design relate to (1) design principles, (2) user attributes, and (3) design contexts. Furthermore, the differences between UX, PEx, and dPEx can be mapped on five dimensions: people, contexts, purposes, means, and usage scenarios. Our insights can help designers and human factors specialists to build a common design language for experience design in healthcare. Our study can also assist designers and human factors specialists with experience design in digital health by pointing out the areas where design thinking generally is appropriate and the places where particular expertise in healthcare design is needed. Considering the findings and limitations of this study, further research on how to involve as many stakeholders as possible within limited design resources in health-related design projects is needed. More studies about promoting design communication among designers of experience design in health are necessary to support better design collaborations. In addition, we propose that future research develop more design frameworks or practical tools based on our findings to assist designers in conducting evidence-based medicine and experience-based design in digital health.

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