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ARTICLE

Challenges for design researchers in healthcare

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ABSTRACT
Design research in healthcare can be demanding. We report on eight challenges that designers and design researchers face when working on healthcare projects. We conducted four workshops with design researchers active in healthcare: six PhD candidates, a mixed group of thirteen design researchers, twelve design students, and eight design practitioners. Participants shared critical events from recent projects and reflected collaboratively to identify common challenges across different design approaches or disciplines. An analysis of the workshop materials resulted in eight themes of challenges, divided into three clusters. The first cluster, challenges in practice, includes (1) *conducting fieldwork*, (2) *involving end users*, and (3) *dealing with sensitive situations*. The second cluster, managerial challenges, includes (4) *managing relations*, (5) *building understanding*, and (6) *communicating value*. Finally, in the third cluster, generic challenges, includes (7) *attuning to time and financial restrictions* and (8) *establishing rapport*. This overview can contribute to design education and practice by helping both novice and experienced designers recognize and anticipate potential hurdles when engaging with the complexities of the healthcare environment.

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Introduction

Going beyond its traditional role in the development of medical devices, design is now broadening its scope in shaping the future of healthcare practice (Partridge 2017; Tsekleves and Cooper 2017; Wildevuur 2017). Healthcare increasingly requires new ways of supporting patients, such as helping them understand the consequences of new treatments and extended lifespans (Lopez-Rangel et al. 2008), promoting proactive decision-making to prevent

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illness and manage complex conditions (Marsac et al. 2014), and facilitating the use of tools to monitor their health on a daily basis (Dhillon et al. 2011). Rather than being centred on the disease, these developments shift the focus of healthcare more towards the experiences, values, and quality of life of patients and their participation in care and treatment (e.g. Sumsion 1993; Ekman et al. 2011). Similarly, health is increasingly no longer conceived merely as the absence of disease, but as the ability of patients to adapt and self-manage. This dramatically changes how professionals, patients, and the public engage with the topic of 'health' (Huber et al. 2011).

We see similar developments in contemporary design research: people and experiences are taken as a starting point in experience design (Hassenzahl, Diefenbach, and Göritz 2010); the potential for design to promote human values is studied in value sensitive design (Friedman 1996); a positive impact on quality of life is a central goal in design for wellbeing (Desmet and Pohlmeyer 2013); and methods for people's involvement in the design process are developed in participatory design (Vines, Clarke, and Wright 2013). Given these parallels between contemporary healthcare and design research, it is no surprise that designers and design researchers increasingly contribute to shaping healthcare.

Designers and design researchers contribute to healthcare in a number of ways. As a discipline working at the interface between people and technology, design has long played an important role in the implementation of new technologies and medical devices in care domains. Furthermore, designers have applied information technology for health promotion through games (Ferguson 2012), wearables (Møller and Kettley 2017), and other design interventions (Craig and Chamberlain 2017; Ludden, et al. 2017). Participatory design has also gained traction in healthcare, empowering caregivers and recipients in shaping their future work and care (Østergaard, Simonsen, and Karasti 2017).

While design can play a valuable role in person-centred care, working as a designer in the context of healthcare can be demanding. In our work as design researchers, we experience a variety of challenges. For instance, healthcare researchers and practitioners are often unfamiliar with design in general, and with design research in particular. We note a number of differences in terms of research methodology. Design research often involves contextual inquiry, an emphasis on qualitative data, and user studies with small samples; in comparison, clinical research often takes the shape of randomized controlled trials with large samples and quantitative data. Similarly, it can be difficult for designers to get accustomed to healthcare procedures, standards, and culture. Finally, obtaining medical ethical clearance for design research studies can cause considerable delays. Through informal conversations with several design researchers, we noticed that many of the above challenges are not unique to our projects, but are actually commonly experienced.

Efforts have been made to identify these challenges. First, several one-off design inquiries report on healthcare-related challenges, such as healthcare professionals' unfamiliarity with the role of design in health (Wildevuur 2017), the expectations of care professionals with regards to prototypes (Reay et al. 2017), and managing multidisciplinary projects, such as the integration of different kinds of disciplinary expertise (Kasali and Nersessian 2015) and dealing with conflicting interests among collaborators (Jansen et al. 2017). While these contributions exemplify that healthcare is a challenging environment for designers to work in and provide actionable insights and suggestions, they do not originate from a collective reflection of designers and design researchers. As such, it cannot be assumed that the challenges also occur outside these specific projects.

An overview of challenges has also been created based on a collective reflection of Human-Computer Interaction (HCI) scholars on multiple projects carried out by different design teams (Blandford et al. 2015; Furniss et al. 2015). Identified challenges concerned research ethics, lack of supportive policies, and the potential disruptive effect of technological interventions. However, HCI researchers often have different research goals and approaches than designers and design researchers. Moody (2015) provides an overview of challenges applicable to design, but specifically focuses on user-centred design (UCD) in healthcare, discussing challenges of user involvement and effective communication of design thinking. Because of the specific focus on a single design approach, these findings do not necessarily reflect challenges shared among a broader range of approaches to design research in healthcare.

In summary, we argue that there is no clear overview of the challenges of design research in healthcare in the current literature. Specifically, previous work lacks generalizability and does not address challenges outside of the HCI or UCD disciplines. We suggest that mapping challenges, informed by a broad range of design practitioners and researchers can support future healthcare and design research collaborations. As such, this paper aims to provide a broad overview of the challenges design researchers encounter when working on projects in healthcare settings.

Methods

We ran a series of four workshops following a pilot-tested format. The main goal of the workshops was to identify key issues based on the participants' personal experiences. For this we took narrative inquiry as our main research approach (Webster and Mertova 2007; Quesenbery and Brooks 2010), investigating the ways in which design researchers experience challenges in their work as depicted through the stories they tell about particular critical events. These individual stories are then retold by the researchers and clustered into themes of challenges (see the *Data collection and analysis* section below).

Participants

A total of 39 participants attended the workshops, denoted as sessions (S) further in the text. We sought for diversity in our selection of participants, which is an appropriate sampling strategy for explorative studies (Baarda et al. 2013, 95). The first session (S1) was conducted with six PhD candidates, of which one had a background as a general practitioner. They worked on various projects including redesign of electronic patient records and participatory service design in nursing. In the second session (S2) thirteen design researchers participated including: students working on their Master's degree; novice researchers with one or a few years' experience in healthcare design research; and more experienced (>10 years) researchers. Examples of projects were the redesign of teamwork processes in the context of cardiology and the creation of a series of critical design artefacts exploring the shift towards home-based care. The third session (S3) was organized with 12 design students taking a master program specializing in design for healthcare at Delft University of Technology. During the session, all students reflected on their experiences with a design project on operating theatres, as part of an elective course they followed. In the fourth session (S4), eight design professionals with an academic or applied sciences background took part. This group had several years' experience of working on projects such as patient journey mapping for chronic disease management and the redesign of a website for a paediatric hospital. Participants in the different sessions were affiliated with various institutions from the Netherlands as well as from Sweden, Australia, Germany, France, and the United Kingdom. Table 1 lists the numbers and background of participants for each session.

Procedure

Informed consent was obtained before each session. All participants consented that the written, auditory, and visual information shared and generated during the workshop would be anonymized and thereafter could be used for publication.

During the 90-minute workshop, participants were guided through a 4-step procedure (see Figure 1). After a general introduction, participants interviewed each other about one memorable event they had experienced

Table 1. Overview of workshop sessions, number of participants and their background.

Session	Location, date	Setting	Participants	Participants' occupation	Background
S1	Brighton, UK, June 28th 2016	Workshop during Design Research Society (DRS) 2016 conference	6	PhD candidates (one former GP)	Various academic institutions: United Kingdom, France, Australia, Germany
S2	Amsterdam, NL, May 17th 2017	Workshop as part of the HospitAbLe exhibition of Lab4Living at Waag society	13	Design researchers (graduate level students, academic and non-academic researchers)	Various institutions: Netherlands, Sweden, United Kingdom
S3	Delft, NL, June 14th 2017	Workshop as part of the master elective "Design of products for healthcare"	12	Design students (graduate level)	Academic institution: Netherlands
S4	Delft, NL, June 16th 2017	Workshop as part of the Masterclass "Design for Healthcare"	8	Design professionals with an academic background	Various companies, Netherlands

while doing design research in a healthcare setting (step 1). A memorable event was defined as *any personal event that the participants specifically remembered as a challenge that affected them, their work, or the context in which they were working*. In order to support the interview process, the participants were given a storytelling interview guide, a blank page for notes, and an *event card*. Participants formed groups of three and each subsequently took the role of interviewer, interviewee, or note-taker. When it was not possible to form groups of three, one person took on the role of interviewer and note-taker simultaneously. The storytelling interview guide was designed to facilitate the interviewer's narratives elicitation by exploring recent experiences of the interviewee (Quesenbery and Brooks 2010). The guide was divided into questions to help the interviewee in thinking of a specific event (i.e. *Can you think of a memorable event that occurred while you were working with design in healthcare?*) and to help the interviewer write down the event (i.e. *When and where did this event occur? Who was there when this event occurred?*).

The interviewer then asked questions to help the note-taker write down a specific event on the blank page, resulting in a description of what, when, where, and with whom the event occurred. The event was summarized on an event card designed to contain self-explanatory short stories. Over three rounds, all three participants occupied each role, resulting in three filled-out event cards which were used in the successive step: *mapping events* (step 2). In this second step, participants were invited to reconfigure into groups of three to four people. Following an approach similar to contextmapping (Sleeswijk-Visser et al. 2005), they were asked to share and complement each

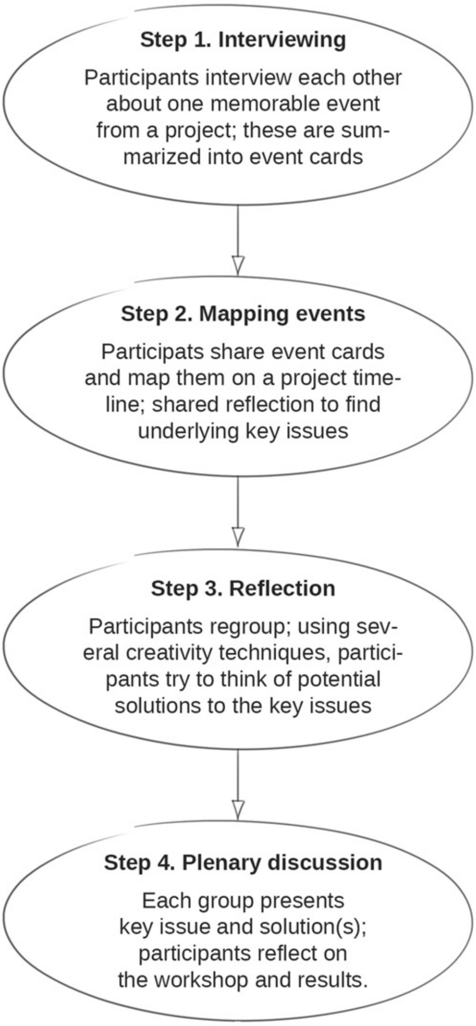

Figure 1. The workshop sessions were organized into four sequential steps.

other's stories and map these on a project timeline (Figure 2, left). A 'timeline canvas' (divided into the phases of project *initiation*, *development*, *implementation*, *evaluation*, and *communication*) was provided. By reflecting together on event cards, participants drew and noted relations and underlying causes that connected the events. Using cardboard *exclamation marks*, they were instructed to identify 1 to 3 *key issues* or overlapping themes.

For the next *reflection phase* (step 3), participants rearranged into new groups of three to four. Each group was asked to select one exclamation mark (i.e. theme) and come up with a potential solution to the challenge described by the theme. This process was facilitated by creativity techniques, including formulating how-to statements, a brainstorm, and a brain writing exercise (van Boeijen et al. 2014, 119). The brain writing exercise, in which

Figure 2. During the sessions, participants mapped critical events and identified key issues (left). At the end of the session, participants presented a chosen key issue with potential solutions (right).

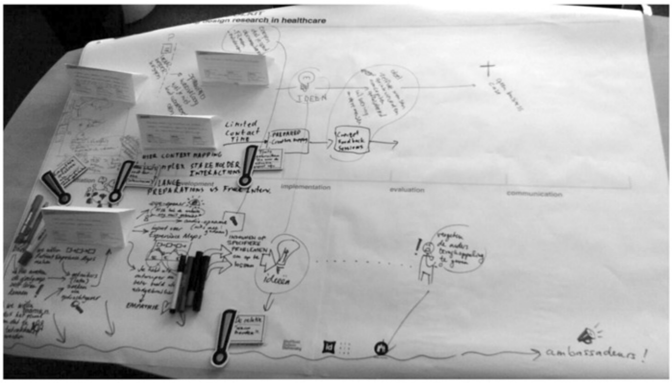

Figure 3. After placing event cards (the upright folded sheets) on a timeline canvas, participants made connections between them and identified key issues (the exclamation marks).

participants wrote down as many ideas as possible in one minute before passing on the paper to their neighbour who builds on these ideas, was only carried out in session 1 due to time constraints. After the creativity techniques, participants were asked to select the one or two most promising ideas and note these on a *solution canvas*. The solution canvas consisted of who, what, where, why, how, and pitfall questions, and encouraged participants to elaborate and visualize their ideas.

The workshop concluded with a *plenary discussion* (step 4). Each group presented their challenge and solution(s) in a one-minute pitch. Together, participants reflected on the presented solutions. Furthermore, they were asked to share their main takeaway message from the workshop (Figure 2, right).

Data collection and analysis

Workshops were audiotaped and all written material generated during the workshop (including event-cards, timelines, solution canvasses) was collected.

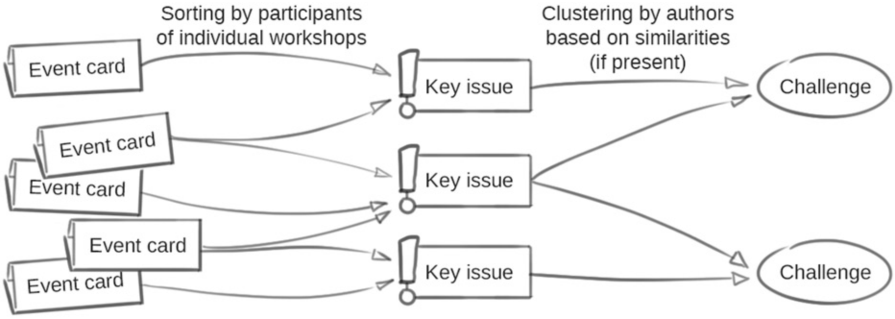

Figure 4. Event cards were clustered into key issues by participants from individual workshops. In the analysis, key issues were clustered by researchers based on apparent or implicit thematic similarities.

The written material was used as primary source of data. Figure 3 provides an example of the written material: a completed 'timeline canvas'. Auditory material was stored as a backup to clarify written statements by participants if required. All materials were anonymized.

We used an inductive approach similar to qualitative content analysis (Graneheim and Lundman 2004) to identify the final themes and clusters. The qualitative analysis focused on the key challenges identified by groups of participants in step 2 of the workshops, as well as the specific experiences of individual participants linked to these challenges.

Data was analysed as follows: in a series of meetings, the authors summarized verbatim key issues (e.g. 'Use tools that are appropriate for the situation' – S4) in keywords (e.g. 'appropriate tools') and labelled these with the corresponding session and project phase(s) on sticky notes. The key issues were then sorted by session and by project phase to identify similar issues that could be merged into one theme (e.g. 'engagement' and 'eureka moment' in S2, both referring to key insights generated from the involvement of end users in the design process). Next, we considered the designers' individual experiences (as written on the event cards) and other notes taken during the workshop to identify similarities and differences between key issues that had not become apparent during the first sort of the data. From these analyses we derived eight higher-order themes that each described one or more key issues originally indicated by the participants. The relation between the original key issues and the final themes was discussed by all authors until consensus was reached on the categorization of the issues to each theme. Figure 4 visualizes this process of analysis; the final clustering of individual key issues into challenges is available on request from the corresponding author.

Since the scope of the work was to identify challenges of design researchers in healthcare, we did not regard solutions described by the participants as part of our interest. Rather, the solutions canvasses were used during the analysis only to better understand and more clearly define the challenges.

Table 2. Main challenges experienced by design researchers in healthcare contexts.

Cluster	Theme	Description
Challenges in practice	Conducting fieldwork	Exchanging expectations and possibilities and reaching agreement prior to fieldwork. (*Agreement*) Adapting to restrictions and unexpected circumstances experienced during fieldwork. (*Adaptation*)
	Involving end-users	Involving care recipients, care providers, or both as end-users during the design project and using their input effectively. *(Effective involvement)*
	Dealing with sensitive situations	Approaching vulnerable end-users carefully and responsibly. (*Vulnerability*) Managing your reaction to confrontations with harm, violence, or death. (*Self-protection*)
Challenges in project management	Managing relations	Being able to gain the attention of, and build mutual interest and trust with, a healthcare organization or practitioner. (*Initiating*) Keeping the collaborators informed and engaged throughout the project. (*Maintaining*) Appropriately concluding the project and the developed relationships. (*Concluding*)
	Building understanding	Recognizing differences in understanding between design researchers, care recipients, and care providers. *(Recognizing)* Acting constructively on the differences in understanding between design researchers, care recipients, and care providers. (*Acting*)
	Communicating value	Clarifying the added value of design work to the stakeholders involved in the project. (*Clarifying*) Aligning different expectations regarding the main value of the design work between design researcher and project stakeholders. (*Aligning*)
Miscellaneous or generic challenges	Attuning to time and financial restrictions	Attuning the project tools and methods to fit time and financial constraints (including limited availability of medical specialists)
	Establishing rapport	Creating a safe and open work context in which stakeholders can communicate easily and without prejudice.

Results

Over all four workshops, participants formulated 20 key issues based on their experiences of design work in healthcare settings. These were clustered into eight themes, and subsequently divided into three broader clusters. The first cluster, practical challenges, includes (1) *conducting fieldwork*, (2) *involving end users*, and (3) *dealing with sensitive situations*. The second cluster, managerial challenges, includes (4) *managing relations*, (5) *building understanding*, and (6) *communicating value.* Finally, in the third cluster, generic challenges, includes (7) *attuning to time and financial restrictions* and (8) *establishing rapport*. These themes and clusters of challenges are presented in Table 2 and discussed in detail below.

Challenges in practice

The first set of challenges presented below relates to issues design researchers encountered when working in the field.

Conducting fieldwork

Several challenges arose when conducting fieldwork in clinical settings. At the start of fieldwork, especially the design students (S3) found it difficult to form *agreements* between involved parties. They expressed a general need to *'know the possibilities'* for fieldwork within a given project, but had to *'balance between being polite and assertive'* in gaining information or getting permission to be present during care procedures. This was further complicated by the fact that some care providers had no clear idea of what '*user research*' entails. For example, students stated that the *'surgeon missed info [about the] research approach*' that the students were taking, and that '*because of a lack of experience with user research, the whole procedure was confusing and difficult to perform*'. The students indicated that they '*lacked knowledge of logistics/context*', concerning for example the '*availability of [the] surgeon*'. Therefore, they saw this as challenge for both designer and provider; both parties *'lacked […] knowledge on how the process would work*'.

The design students mentioned that even after they reached agreement on fieldwork, they encountered challenges in adapting to unexpected situations. They stated that *'preparations do not always match reality'*. More specifically, students needed to adapt to restrictions: 'the environment is so controlled, it is difficult to improvise'. Others described how the *'surgeon was very strict and closed. That restricted research activities'*. Students encountered a variety of unpredictable circumstances. For example: *'when I went to the hospital I had no guidance from the surgeon and felt lost'*. In another case, a *'surgeon [told] her to wait and she appeared after two and a half hours'*. This led us to conclude that challenges in fieldwork may arise at two points: first when establishing agreement about the possibilities and need for user research in healthcare settings, and second, in adapting to restrictions or unpredictable circumstances.

Involving end-users

Participants discussed the direct involvement of end users, for instance, in early prototype testing. When carrying out this work during healthcare design projects, participants encountered difficulties both in *involving* care recipients and/or care providers, and in using their input *effectively*.

User involvement was considered indispensable in producing valuable insights: *'insights into the needs of different users'* (S4) and *'valid insights to inform and develop prototypes'* (S2). However, it was experienced as challenging because care providers mediated the contact between care recipients and designers. This meant that contact with recipients could often not be arranged directly if the care providers were unavailable, despite availability of both other parties. For example, one participant had to postpone interviewing surgical patients due to unavailability of the surgeon: '*it took a while before [I] was connected to the orthopaedic surgeon. Communication took a long time*' (S4). Strict protocols in clinical settings were mentioned as a potential cause; designers addressed this by substituting (possibly harmful or invasive) medical devices with simple prototypes that simulated the experience: *'[it is] difficult to test in healthcare settings (rules, privacy, etc.) but much is possible [when] using prototypes or simulations'* (S2).

New challenges of effective involvement emerged when participants had succeeded in contacting end-users. For one, it was noted that care providers and recipients were not accustomed to being involved in design and taking on a designer's role. Participants described *'the facilitation of helping people realize their ideas'* (S2) as challenging, while it is relevant for *'allowing, enabling people to recognize they can help make and facilitate improvements and solutions'* (S2). It required the *'designer's ability to be humble - not impose ideas'* (S2). Together, these different aspects (e.g. arranging contacts, facilitation, and redistribution of roles) indicate a twofold difficulty in user involvement: not just to reach end-users, which was challenging specifically for care recipients, but also in involving all parties effectively.

Dealing with sensitive situations

A particular challenge of becoming immersed in the healthcare context and lives of vulnerable users relates to the sensitivity of this context. Sensitivity in healthcare contexts was described in two ways: taking the *vulnerability* of care recipients into account, and ensuring *self-protection* in sensitive situations. Vulnerability of stakeholders may surface unexpectedly, as noted by one participant: in a redesign project for a hospital website, parents of ill children talked with the design researcher about how they experienced their current situation and they suddenly became '*emotional.*' (S4). Other participants consciously anticipated such situations; for example, one of the participants decided to take his time in making the care recipient feel more comfortable during the interview: '*so she trusted the designer and could share very intimate information*' (S4).

Dealing with sensitive situations may also entail self-protection for the design researcher. An exceptional case was reported by a PhD candidate (S1) who witnessed direct and indirect evidence of harm inflicted on children when doing fieldwork for her project. She expressed that *'being confronted with violence exerted against children through observations or testimonials'* was an intense experience. The same participant then rephrased her thought by asking the workshop audience *'How do we talk about death and violence?'* (S1), suggesting that it is no easy task. This highlights two aspects that the designer and design researcher should take into account while dealing with sensitive situations; first, that some (unexpected) research situations are delicate for care recipients, and second that the design researcher may be confronted with situations that are emotionally charged and intricate.

Challenges in project management

Executing design work in the field is only one part of designers and design researchers' work. A large part of their job is related to project management: e.g. securing funding, tracking and communicating process, and engaging stakeholders. The set of themes below describes challenges related to managerial issues experienced in healthcare-design projects.

Managing relations

The participants described that care recipients and care providers were not only involved as end-users, but also as research collaborators. Effectively managing relations with and between these collaborators throughout the project was considered beneficial, yet challenging by participants at all levels of experience. Challenges in managing relations were described in three phases as initiating, maintaining and concluding relationships.

With respect to initiating a relationship, participants wondered *'How to motivate doctors to get actively involved in the development of a new product or service'* (S4). One participant in particular shared that it took her '*two months before [getting] in contact with the orthopaedic surgeon.*' (S4). In maintaining relationships, participants expressed difficulties in '*keeping the door open'* (S1), keeping *'stakeholders motivated and enthusiastic'* (S4), *'building trust'* (S1), and finding ways to *'share the process and steps'* (S4). Conclusion of relationships was discussed rarely and only in relation to care recipients. Nevertheless, it posed a challenge, as one participant expressed that the team *'forgot to give parents [of patients] feedback'* about design results in the final stages of the project (S4).

Building understanding

One preliminary solution to effective relationship management posed by the participants included building empathy and understanding between collaborators and end users. Yet, building understanding was experienced as challenging in itself. Challenges regarding understanding manifested in two ways: *recognizing* the need for understanding and *acting* upon understanding.

In recognizing the need for understanding, design researchers referred to care recipients and the necessity to 'step into their shoes'. One participant described how a situation helped her to better understand elderly with dementia: *'during an interview with a couple with dementia, after 45 minutes* *the patient suddenly forgot that he was a patient.'* (S2). A PhD candidate expressed that *'meetings can turn into tough moments'* (S1), explaining that this happened in one of her projects due to misalignment and misunderstanding between various stakeholders.

When acting on these differences in understanding, participants shared that because they are *'being confronted with the fact that they had strong assumptions about a situation, there is a need for reflective tools to reframe the problem […] and the means to address it.'* (S1). Some participants already had strategies in place to reframe and be reflective. For instance, one participant considered rephrasing terms and language to be attentive towards the other parties: *'changing own words is being empathic'* (S2). Other participants agreed that adopting specific techniques such as *'Appreciative Inquiry'*[1] (S2) helped define the set-up of the investigation and could encourage everybody in the project to speak the same language.

Communicating the value of design

Related to building understanding was the challenge of communicating the value and contribution of design (research) to healthcare. All participants except the PhD researchers discussed how challenging it is to *clarify* this value and to align expectations on the design outcomes. The ability to argue for the value of design work was considered especially important during project initiation. For example, the designers felt they had to demonstrate *'what is in it for the interviewee'* (S4) as their projects required initial time, energy, and monetary investments of stakeholders. When the added value was unclear, they felt it was difficult to justify these investments.

Design students in particular experienced difficulties in communicating value: *'[it is] not clear what an industrial design student does and/or can do'* (S3). Yet, a more senior design researcher also described that *'I had a hard time bringing my expertise across when doing in-context research at the hospital'* (S2). The breadth of design as a discipline, including *'fashion design, product design, graphic design, process design'* (S2), further complicated discussions on the value of design as stakeholders (including the designer) had different notions of value. Other participants agreed, yet also considered this an opportunity for the design research field to frame its contribution to the healthcare sector: *'they know they need design, not why. For designers, this is an opportunity to see what design can be.'* (S2). As one participant put it, *'what is "design" and what is "health"?'* (S2).

Value was also discussed in terms of *aligning* expectations regarding the outcomes of a design project. Participants expressed that some clinical stakeholders expected a specific end product (e.g. a device, a website) while they regarded the design process itself also as valuable. *'Care people want to jump to results'* (S2) one design researcher wrote in response to an event shared by a junior designer, who had finished a project about training residents in the operating theatre. *'The surgeon asked right away, "what will you do?" They are focused on results. That is the way they are taught.'* (S2). Becoming aware of these different expectations and aligning them between stakeholders was viewed as a complex challenge.

Generic challenges

In addition to the practical and managerial challenges discussed above, other miscellaneous topics were highlighted by the participants. These more overarching or generic challenges concern difficulties that can aggravate other challenges, thereby slumping or limiting research efforts. These comprised challenges with attuning to time and financial restrictions, and in establishing rapport with stakeholders.

Attuning to time and financial restrictions

Financial and time restrictions can have a major impact on a project's development and success. Due to budget limitations, participants experienced that it was sometimes hard to reach professionals or keep in touch with them (see also 'managing relations'). One designer commented that once a connection was established *'communication has [had] large lags'* (S4). Only afterwards did he discover that this was a consequence of monetary concerns, as the specialist could not be reimbursed for the effort in the design project. Time restrictions turned into a challenge when the aim was to *'[…] arrange contact moments with users and get feedback within very limited time'* (S4).

Establishing rapport

Many of the previously described challenges were considered to result from the different, even contrasting, nature of the domains involved: health (research) following structure and strict protocols, and design (research) processes based on flexibility, ambiguity, and creativity. Participants discussed a general necessity to *'understand how other dialects express themselves'* (S2) in reference to the two knowledge domains (e.g. health and design). Creating a safe and open work context in which all stakeholders could communicate easily and without prejudice was considered a substantial challenge, as well as the main bridge capable of linking the two different fields.

Discussion

The aim of this paper was to understand and make explicit what challenges designers and design researchers face when conducting design work in healthcare contexts. We identified eight overarching challenges and divided these into three clusters: challenges occurring in practice, challenges in project management, and generic challenges that may aggravate other challenges. Although these challenges were described separately in the results, they are interrelated in various ways.

In Figure 5 we present a tentative overview of interrelations among the different themes and clusters of challenges. What we can see from the diagram is that challenges concerning project management and practice mutually influence one another. For example, a lack of understanding might result in unexpected restrictions and delays during fieldwork. This in turn complicates relations with stakeholders. Across the entire 'landscape' of challenges, *building understanding* plays a pivotal role due to its effects on managing relations and communicating value. We expect that building a good understanding among stakeholders can help avoiding many obstacles related to the other themes. Finally, the two miscellaneous challenges at the bottom of the diagram retain a more structural role in projects in healthcare. They underlie many of the other challenges. For example, attuning to time and financial restrictions plays a role in managing relations as well as conducting fieldwork.

Due to the interrelations between challenges, addressing one challenge may contribute to solving other challenges. For example, participants envisioned that the care providers they collaborated with should become design research ambassadors to improve relationship management. Potentially, if clinical researchers would advocate design research to other colleagues, this could also communicate design's value. Despite this overlap, we feel that all themes do provide a specific set of challenges to focus on. Our experience is that discussing the various separate themes naturally results in making sense of their interconnections.

We do not assume that the challenges identified in this paper are necessarily unique to the healthcare context. They may be encountered more generally in interdisciplinary or participatory projects, or studies that involve extensive fieldwork. However, we do expect that many challenges are more prevalent, recurrent, or demanding in healthcare. For example, involving end-users can prove to be more difficult, since contact with care recipients generally occurs via care providers and involves additional medical ethical considerations (Noël 2017). In many other contexts, end-users can be approached directly, and this often requires fewer ethical considerations.

The challenges identified in this study are similar to those found in qualitative health research. For example, the perceived value of clinical qualitative

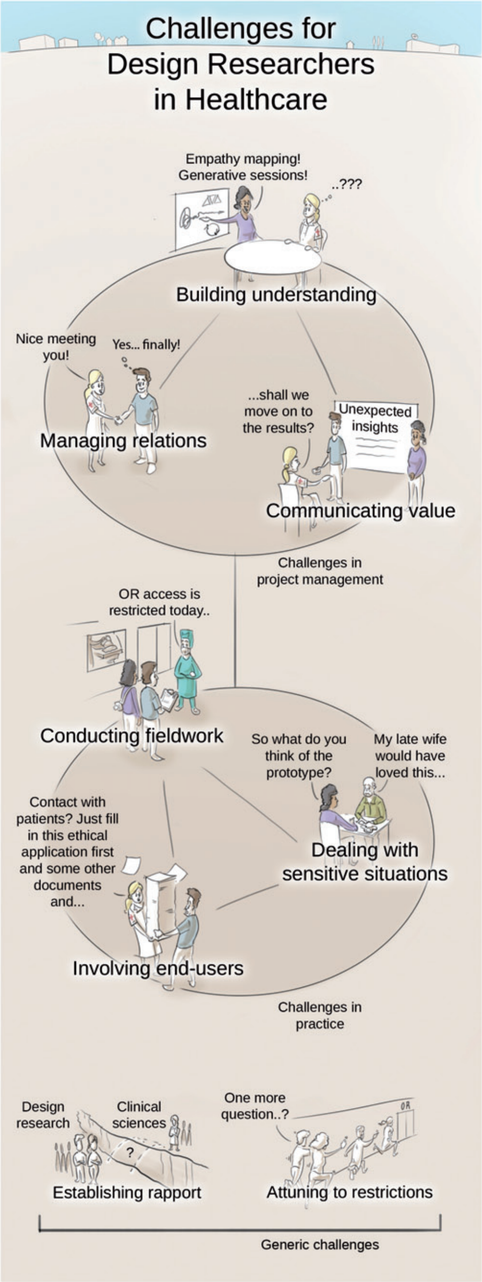

Figure 5. We identified eight themes of challenges that design researchers encounter in their work in healthcare contexts. These challenges relate to one another in various ways.

research is often questioned (Daniels, Hanefeld, and Marchal 2017). With respect to vulnerability and sensitive situations, social researchers in healthcare have made a strong effort to provide guidance and support under the label of 'sensitive research' (Dickson-Swift, James, and Liamputtong 2008).

These extensive and elaborate contributions in the social sciences can serve as a valuable resource for design researchers as well, as their work is often qualitative and occurs in close contact with care recipients.

Our paper contributes to previous work in several ways. First, the challenges are grounded in the experiences of a variety of design researchers working in various contexts. In this way, it represents a broader design community than previously considered (e.g. Wildevuur 2017; Reay et al. 2017; Furniss et al. 2015; Moody 2015). Second, this broader scope has resulted in a more complete set of challenges. In particular, the challenge of communicating the value of design was not reported in existing overviews. As we do not expect collaborations between the design disciplines and healthcare to decrease, the current broad overview can equip project managers, designers, and policy makers with timely knowledge to ensure success in future collaborations in healthcare.

Our findings have several implications. We specifically want to emphasize the educational value that our findings have for design students and researchers, and how both the design field and the healthcare field can learn from this content and anticipate hurdles during collaborations. There is a growing interest among design students in design for healthcare and well-being (Boks and Baggerud 2015). However, the design methods currently taught to design students do not sufficiently prepare students for the complex nature of healthcare contexts (Norman 2016). Others have highlighted the need for designers to cultivate skills and competences in order to perform patient-centred and evidence-based design in healthcare (Noël 2017). The challenges identified in this paper can serve as focal areas for developing and selecting the educational methods, skills and competencies to address in educational programs. Furthermore, the overview of challenges and their interrelations in itself may provide a valuable framework for design students to make sense of the complexities of working in healthcare and to contribute to what Aspinwall and Taylor (1997) call ‘proactive coping’ – i.e. the process of anticipating problems and taking steps to prevent or modify them. Aspinwall and Taylor note that successful proactive coping requires problem owners to actively engage with these challenges, as opposed to trying to avoid them. Finally, we suggest that the abovementioned implications do not only apply to students, but extend to design practitioners and researchers who deal with managerial and fieldwork-related challenges on a regular basis.

This study also has several limitations. First, as in any qualitative work that involves interpretation, our personal experiences may have influenced the final selection of themes. Second, the overview of challenges is based on events that happened in the European, British, and Australian healthcare context. While we tried to include a wide range of possible professionals in the study, the cultural characteristics of these specific countries may have resulted in an overview that is not exhaustively representative for non-Western practice. Third, the workshop took place in an active group setting and mostly relied on written participants' statements. This resulted in less detail compared to qualitative interviews. Still, the variety of quotes allowed us to provide rich and informative descriptions of the challenges. Fourth, the intention of this paper to provide a generic overview of challenges may have led to the disregard of specific challenges related to a particular domain of care. Whether these specific challenges still fall within the themes identified in this paper, only future work can tell. Fifth, the identified challenges of 'user involvement', which emerged mostly during workshop 4, may be partially influenced by a master class in Patient Journey Mapping participants attended directly prior to the workshop. This method promotes user involvement and may have made the topic more salient to participants. A final limitation is that more than half of the participants could be described as novice design researchers; this could mean that several challenges may simply be overcome through experience. Future work can perhaps better distinguish between challenges of novices from those challenges that are more tenacious and independent of the level of experience or expertise.

Several future research directions can explore aspects not fully addressed in this paper. First, it would be valuable to know whether these challenges only occur in healthcare settings. As previously mentioned, we suspect that challenges are likely not unique to healthcare contexts; but rather more substantial there. For design education, it is especially important to gain a clear understanding of unique challenges, as these may point to specific strategies or skills to be addressed in curricula. A second direction for future research is to explore the prevalence, frequency, and impact of specific challenges. This should also include gaining a better understanding of how these challenges develop over time, for example, throughout the course of a project or collaboration. Together, the suggested research directions can create a more nuanced understanding of healthcare-related challenges and their dynamics. This can serve as a solid basis for devising new strategies and methods for design research in healthcare.

Conclusions

As healthcare is moving from a disease-oriented model towards care that aims to support and empower patients in various ways, exciting opportunities are emerging for design to contribute to the wellbeing and positive experience of both care recipients and care providers. However, conducting design research in healthcare settings is not an easy task and poses challenges for both novice and experienced design researchers. In this paper, we identified eight themes of challenges, ranging from dealing with sensitive situations to managing relationships with stakeholders and communicating the value that design can bring. The overview of challenges is a unique contribution as it is based on real-life experiences from a variety of design researchers with diverse disciplinary backgrounds. We suggest future work should explore under what conditions these challenges occur, what effects these challenges have on the design work as it emerges over time, and above all, which strategies are suitable to deal them. We trust that our overview of challenges will serve as a set of focal areas for design educators, design researchers, and project managers to formulate strategies that help them work more successfully in the complex environment of healthcare.

Notes

1. Appreciative inquiry is "a research perspective intended for discovering, understanding, and fostering innovations in social-organizational arrangements and processes" (Cooperrider and Srivastva 1987: 124)

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