

# From Concept to Practice\*

## Rethinking Proof-of-Concepts for Healthcare Research

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### ABSTRACT

In healthcare research, Participatory Design (PD) fosters open-ended processes grounded in democratic ideals and power redistribution. However, the epistemological commitments shaping this research can be difficult to account for and may even remain invisible in publications. We reflect on Proof-of-Concepts (PoCs) to make insights useful moving from concept to practice in a design project ‘iAware’. We show how PoCs can cultivate and mediate insights from the complex, messy realities of PD and its democratic potential. We ask: A PoC can be seen as a beta prototype that addresses functionality, but can it also be a prototype designed to rebalance power dynamics and ensure that participants with legitimate expectations are actively involved in its design?

### CCS CONCEPTS

• Human-centered computing • Collaborative and social computing • Empirical studies in collaborative and social computing

### KEYWORDS

Participatory Design, Hospitals, Workflow systems, Patients and relatives, Care Workflows, Proof-of-Concept

### ACM Reference format:

Naja Holten Møller and Trine Rask Nielsen. 2025. From Concept to Practice: Rethinking Proof-of-Concepts for Healthcare Research. In *Proceedings of (CHI '25 Workshop on Envisioning the Future of Interactive Health)*. ACM, New York, NY, USA, 4 pages. <https://orcid.org/0000-0002-4324-3745> <https://orcid.org/0000-0002-9787-9052>

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### 1 Introduction

Across Human-Computer Interaction (HCI), there are substantial differences in how Proof-of-Concepts (PoCs) are used to evaluate research designs [1, 6, 10]. We report insights from a Participatory Design (PD) project ‘iAware’ [4, 8] that aims to leverage awareness of care workflows between patients and health care workers (HCWs). In the project, we rely on a PoC format to move from the research prototype (concept) to the industrial prototype (practice). The aim is to provide new types of data about care work to give patients and their relatives a better picture of their day – and to support HCWs with more ways to provide this information.

We take PoC as our starting point for discussing some of the challenges that arise across similar, yet different types of healthcare research as we try to account for the decisions we make in such projects. We are interested in how PoCs can be useful as a format for communicating the epistemology that shaped the research, thus ensuring the democratic ideal of participatory methods in design projects.

For this paper, we argue that PoCs can make our epistemological commitments in health research more accessible in terms of the purpose and meaning of the knowledge we produce. And in how we envision the future of health research across different but complementary types of knowledge in design projects.

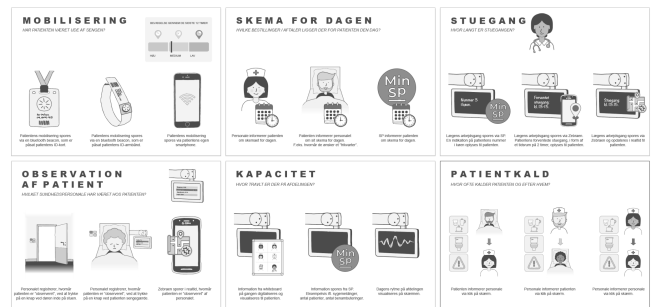


Figure 1: The care workflow scenarios representing varying levels of data use, ranging from manual data entries to more data-driven entries

According to Bardram, in the technology industry, PoC is used to test concrete applications [1]. As such, a PoC at a minimum demonstrates a prototype application in moving from concept to practice. The term 'prototype' can have different meanings across disciplines and organizations. Here we define a prototype by its function—how it is used to explore or demonstrate aspects of a future technology (following [5]). The PoC allows for others to assess a prototypes functionality, address challenges, and core elements before advancing further. One way that the PoC format can tease out our diverse approaches to epistemology in healthcare research is, for example, in terms of what we consider as the requirements for a prototype: **A PoC can be seen as a beta prototype that addresses functionality, but can it also be a prototype designed to rebalance power dynamics and ensure that participants with legitimate expectations are actively involved in its design?**

A strictly technical PoC can be defined as a concept for a proposed new technology or application, and the subsequent evaluation of its implementation in a limited setup [1, 11]. The problem with this definition, Bardram argues, is exactly its neglect of the people serving as “subjects” for the study. Instead, he suggests a reorientation of healthcare research towards a Clinical Proof-of-Concept (CPoC): “[...] a working prototype that is usable (but not necessarily user-friendly), works on its own, and is focused on addressing specific research questions. This technology should be deployed in a real clinical setup, should be used by real users (researchers are hands-off), for a short, but sufficient period of time, which –depending on the research question – may range from 1 day to 3 months”. [1 p. 52].

Unlike other types of PoC, which typically take place as laboratory-based and technical studies with more controlled setups, iAware uses the redesign of Danish hospitals as our setting. In the future hospital, single-patient rooms aim to enhance care. A patient screen will be available at the patient’s bedside. iAware will be tested on the patient screen and on the HCWs tablets. For this PoC, we developed design criteria reflecting the participatory design approach [2, 3]. Working with industry partners, the PoC serves as a knowledge broker in the transition from one phase of prototyping to the next: In particular, the PoC conveys the obligations of the PD approach through the project’s design criteria.

## 2 Co-design .. One Step at a Time

Once a patient is admitted, information on care workflows only appears to patients and their relatives when communicated explicitly (typically verbally) by the HCWs in person. Concretely, this means that patients call the HCWs to have information about their day. iAware investigates the possibility of supporting awareness by co-creating a research prototype and scenarios for the use of sensor data in care workflows.

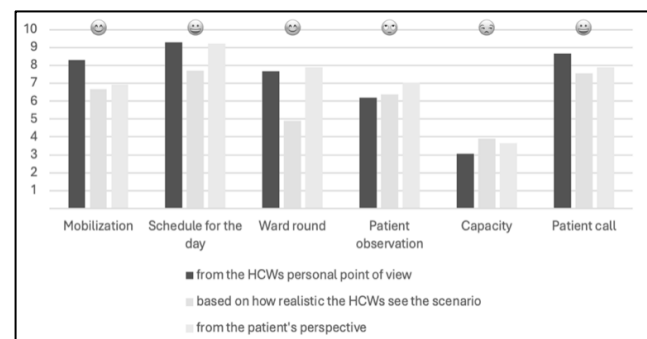
Sensed environments enable care for a broad group of patients with varying capabilities. In a hospital setting, HCWs shuffle and re-shuffle queues of patients in the day-to-day activities of their workflow. Both from a patient and HCW perspective, there is a need for actively exchanging information [8]. Bringing HCWs, patients and relatives into this kind of design process is not a one-time event; rather, it involves a series of iterative steps to co-create a research prototype that makes sense to them. We worked with 2 hospital wards over the course of a year (2024-2025).

In the first phase of the iAware project (taking an ethnographic approach) involved a baseline study, in total 74 hours of observations of nurses and nursing assistants. These findings informed the **development of care workflow scenarios** (Figure 1).

In the second phase, four participatory workshops were conducted with nurses and nursing assistants (n=21). During these workshops, **participants ranked the care workflow scenarios** using an IDEO-inspired matrix (Figure 2).

The third phase, we incorporated patient (n=7) and relative perspectives (n=10) through online focus groups (in total 3), which they could attend flexibly over the course of a week. This format was essential, **allowing patients and relatives time to reflect** while considering their “lived experiences” during hospitalization. These insights helped refine iAware, making a clear assumption that it should serve as a supplement—rather than a replacement—for direct interactions with nurses and nursing assistants.

In addition, union representatives were involved as we later revisited the **next iteration of the research prototype of a patient screen** together with the HCWs. In this sense, the PoC serves as the material manifestation of the key insights.



**Figure 2: Average scores of 21 nurses and nursing assistants who participated in the workshops. The scores indicated the least interest in the scenario showing information about the ward’s capacity on a given day (how busy the ward is on a given day)**

### 3 Design Criteria

Our participatory approach follows the principles established in PD design [2, 3]; however, the challenges remain, ensuring that iAware aligns with our commitment to the participants' needs and ethical considerations when moving to industrial design. To ensure commitment to the PD approach throughout the project, the PoC communicates the design criteria of the iAware methodology as guiding principles:

- A democratic approach to user involvement
- Adapted to and learning from existing and new workflows
- Taking outset in a realistic data foundation
- With an ethical and legal use of data
- Accounting for decisions and assumptions in the project

**The first** design criterion sets an ambition for iAware to take a democratic approach to the development of the new patient screen. In other words, it rests on the assumption that HCWs - and patients and their relatives - have expert knowledge when it comes to care work. HCWs know the details of mobilizing a patient, which can be anything from turning the patient over in bed to walking to the hot dog stand in front of the hospital, depending on the type of patient. Patients know what mobilization is like for them and what information they want about this part of their care. And it is this deep knowledge that they have from everyday life that is crucial for a future patient screen to make sense.

To ensure that we in the iAware project have the necessary understanding of HCWs care work on a daily basis, which is the **second** design criterion, we conducted the baseline study, of when patients and relatives need to contact nurses and nursing assistants. By observing work on different shifts - day, evening and on the two hospital wards N11 (Department of Neurology) and M4 (Department of Orthopedic Surgery) in the hospital that we collaborate with, we identified 6 care workflows (scenarios). These scenarios formed the basis for our dialogue with patients, relatives, and HCWs about the design and development of the patient screen and how it could support mutual awareness of care workflows.

The **third** design criterion is about ensuring a realistic data basis for future patient screens. Hospitals are complex machines, and staff should experience that the same technologies are used by all systems as far as possible (HCWs use the so-called "Zebras" today, which is a tablet that also emits Bluetooth signals). It is a critical premise in the project that patients, relatives and HCWs can indicate if they prefer manually entered data, which is based on their current workflow. For example, each patient has a whiteboard by the bed for noting down the concrete needs of a patient (e.g. the aids that a patient needs).

**Figure 3: The IDEO matrix used in participatory workshops with nurses and nursing assistants, evaluating the care workflow scenarios from a personal, organizational, and patient perspective**

A **fourth** design criterion is thus to ensure ethical use of data. The challenge when using data is in ensuring that HCWs, patients, and relatives on the one hand can take care of their own interests and needs for information about the care work. On the other hand, an important part of PD is also to ensure that they can understand each other's needs [4]. The patient screen can provide patients and relatives with information they have not had before, giving them a sense of greater flexibility, for example in terms of being able to leave the ward - which can make HCWs feel less flexible in their work. It is therefore crucial to work with mutual understanding in the design of the patient screen.

The **fifth** design criterion is transparency in the design process, of which this Proof-of-Concept (PoC) is an important part. iAware's premise is to develop a patient screen that creates the basis for better mutual understanding of care work between patients, relatives and staff. The central assumption of the project is that patients, relatives and staff will experience more trust, security and well-being through relevant information (following [9]). Figure 2 shows a summary across the 4 workshops held with the HCWs at N11 and M4, where their priorities have formed the basis for the second version of the research prototype. Similarly, staff themselves have pointed to other scenarios in the PD workshops.

### 4 Conclusion

Drawing on PoC, Bardram [1] extracts both technical and organizational insights, particularly regarding how a research prototype functions within a work environment. Similarly, in iAware, we also focus on the employee's work environment but also on the well-being of patients and their relatives [8]. While employees (including HCWs) may always be faced with a need to organize for better working conditions, and citizens (including patients) may always need to self-advocate for better service provision [4], our role as researchers is to ensure that both can consider each other's needs when designing AI technologies [4 p. 1]. Our primary interest in PoC is to provide



**Figure 4: The iAware research prototype pictured here on the patient screen, designed around 4 of the 6 care work scenarios based on the insights from participants in the PD workshops**

a documentation format that facilitates the transition from a research prototype to an industrial prototype—as a knowledge broker of the insights arrived at. Bridging across different types of healthcare research is challenging, we know from prior attempts to articulate a research agenda across fields [7]. We suggest taking PoC as a starting point for understanding some of the challenges related to prototyping: The term ‘prototype’ can have different meanings across health research and organizations, with stakeholders holding distinct expectations of what qualifies as a prototype. We invite discussions on how PoCs can be reimagined in a PD context, ensuring our epistemological commitments are aligned despite our different methods as we move from one phase to another in a design project.

## ACKNOWLEDGMENTS

We sincerely appreciate the generosity of all participants in this study for sharing their time, insights, and experiences. Thank you to our collaborators and colleagues in the iAware research project for their invaluable contributions. This study was made possible through the support of Innovation Fund Denmark.

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