Scenario-Based Methods for Hard-to-Reach Populations in Healthcare

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Abstract. Scenario-based design (SBD) is an iterative concept-generating method where designers and researchers create short narratives to develop concepts for a design. This method also allows for rapid revision since it incorporates a way of assessing the claims and pros and cons of the concepts in each scenario. There are four types of scenarios that can be created and assessed, but the overall method remains flexible. We held three sessions with design and human computer interaction students. The objective of these sessions was to brainstorm a few unique concepts for a tool that would provide automated feedback to primary care physicians about their interactions with patients. In this paper, we detail our process and how we adapted and applied the scenario-based design methodology. Due to clinicians' often limited time and design experience, we adapted SBD methods to help nonclinical designers better understand the context of clinical work settings. To adapt the methods, we 1) held a preliminary design workshop with clinicians to sessions to inform the scenarios, 2), involved designers in the SBD sessions, and 3) provided the non-clinical participants with relevant contextual and background information about primary care settings.

Keywords: Scenario-based design · Human-centered design · Healthcare

1 Introduction

1.1 Scenario-Based Design

Scenario-based design involves creating short stories or experiences (scenarios), to design, iterate, and evaluate concepts. This method was first introduced by Rosson and Carrol (2002a, 2002b). It allows designers and researchers to move from initial research and information gathering of defining the problem to the concept development and prototyping. This process uses the described context of how and where the design would be applied. This helps participants better consider how constraints of an environment may shape use (Rosson and Carroll 2002a, 2002b). An advantage is those without a specific experience or background (such as having a medical degree and working as a physician) may still visualize the design in context due to the description in the scenarios.

Scenario-based design methods have been used in various healthcare situations. One study, focusing on goal directed design, aimed to design a clinical decision support

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system to improve management and detection of urinary tract infections (UTIs), as well as decrease antibiotic overuse. After conducting focus groups to gather information from clinicians on their use of technology and UTI management, the researchers used personas and scenarios to create and test prototypes. They noted this as a good way to design a clinical decision support system (Jones et al. 2017).

Other uses of scenario-based design in health-focused settings occur around assessing tasks and using scenarios to illustrate and investigate workflow. While scenario-based design is, at face value, an inexpensive, fast, and resource-light technique, challenges may also exist in creating concise and clear models from the data. For example, the use of scenarios in analyzing workflow and designing for infectious disease surveillance were noted as helping to create design requirements, but the authors also noted the difficulties of creating a workflow chart that was both high-level and detailed while using this process (Turner et al. 2013).

1.2 Research Background

These scenario-based design sessions are part of a larger study to develop tools to provide feedback to physician about their interactions with patients in primary care settings. The intent of this system is to improve physician satisfaction and practice, along with patient health.

Physicians receive varied forms of feedback on their practice. The impact of these types of feedback may vary as well. They may receive patient surveys, but the value of these is unknown (Farrington et al. 2017). Surveys may not pick up on the types of behaviors that are difficult to detect, but still influence patient-physician interactions. For example, higher levels of physician eye contact with their patients are found to be associated with greater patient satisfaction (Farber et al. 2015).

Hartzler et al. (2014) investigated the efficacy of standard feedback approaches along with developing and testing new ways of providing feedback to physicians. One illustration of the feedback tool concept is a system that provides visual feedback throughout the appointment to help the physician correct specific communication skills (Hartzler et al. 2014). In this study, participants were generally positive about the system but noted concerns that the real-time feedback could distract physicians from the task at hand.

There are several considerations when designing a feedback system, particularly if it is used during the patient visit. It should not act as a distraction from the patient, and physicians should be able to quickly understand the feedback (Faucett et al. 2017; Hartzler et al. 2014). In another study that evaluated response to visual feedback during telemedicine calls, participants did not feel that the feedback was overly distracting. Additionally, the researchers found that the system improved the balance of talking between physician and patient by decreasing interruptions and the amount of time talking in instances where physicians talked more than the patient (Faucett et al. 2017).

1.3 Paper Objectives

The objective of these sessions was to develop low-fidelity prototypes of a feedback system based on scenario-based design activities. Applying the scenario-based design process allowed us to create and evaluate several scenarios to inform design concepts

for the feedback system. In order to brainstorm concepts for the physician feedback tool, we adapted Rosson's and Carrol's scenario-based design framework (Rosson and Carroll 2002a, 2002b). Figure 1 illustrates our workflow up to this point to conceptualize, analyze, iterate, and create prototypes from the scenarios.

Several studies have explored feedback in clinical settings and physician perceptions and preferences for feedback, yet few describe Rosson and Carroll's process using the four unique scenario types, from exploring and defining the problem to creating and testing a concept using scenario-based design. In this paper, we describe the use of scenario-based design methods in the context of designing tools for physicians. We provide a detailed write-up of our methods, along with the adaptations we made for this method to work for the healthcare context with nonclinical participants.

Several factors inspired our adaptations of the methods. These are primarily our reliance on human-computer interaction students and professionals for this phase and the fact that the scenario-based design sessions were all conducted remotely. Our preferred participants would be primary care physicians, since they are the people for which we are designing. However, this is a busy and difficult-to-reach population. Furthermore, due to circumstances at the time of conducting these sessions (the COVID-19 global pandemic), conducting the sessions in person was not an option. In this paper, we reflect on the use of nonclinical participants in creating concepts, along with the methods and challenges of conducting research using remote tools and methods.

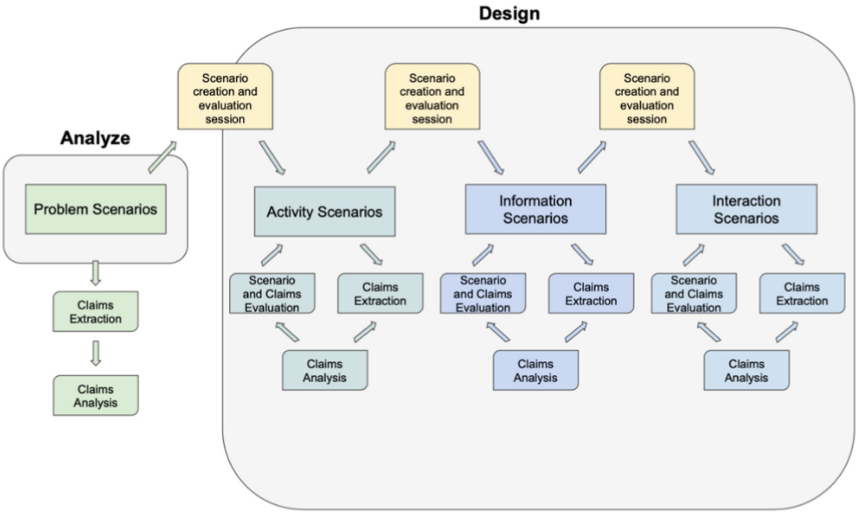

Fig. 1. This figure illustrates the process of writing and analyzing the four scenarios.

2 Methods

We held three sessions to create the scenarios. The goals of these sessions were to brainstorm, evaluate, and iterate on concepts for a feedback system. Figure 1 shows how

the four scenarios were written and analyzed. The process of creating and preparing for these sessions consisted of researching and adapting methods of scenario-based design activities in a remote group setting.

2.1 Scenario-Based Design Sessions

There were three 90-min live (remote) sessions, one session each for the activity, information, and interaction scenarios. The problem scenario was created prior to the first session and was informed by a previous design workshop. Brief descriptions of each type of scenario are found in Table 1. In the sessions, participants were involved in creating the scenarios, evaluating the scenarios for claims, and analyzing the pros and cons of those claims.

Table 1. Scenario type with associated inputs and outputs

Scenario	Inputs	Outputs
Problem: – Analyze phase – Describes a situation where negative outcomes might occur due to inadequate tools or circumstances – Written by researchers	– Artifacts and themes from a previous design workshop with family medicine residents	– Claims/design requirements – Claims analysis – 1 problem scenario
Activity: – Design phase – Proposes a design to address issues and claims raised in the problem scenario – Created by session participants	– Problem scenario – Claims from problem scenarios	– Claims/design requirements – Claims analysis – 3 activity scenarios and claims evaluations
Information: – Design phase – Describes information the clinicians need and use – Created by session participants	– Activity scenarios – Claims from activity scenarios	– Claims/design requirements – Claims analysis – 3 information scenarios and claims evaluations
Interaction: – Design phase – Details how clinicians interact with the technology – Created by session participants	– Information scenarios – Claims from information scenarios	– Claims/design requirements – Claims analysis – 3 interaction scenarios and claims evaluations

Students with experience in human-computer interaction (HCI) and health-based fields were invited to participate in these three sessions. A total number of 15 people participated in the sessions, two of which attended two sessions and one of which attended all three. All participants, apart from one nursing student, were in the human-centered design graduate program. Three participants identified as male and twelve as female. Median age of attendees was 26 (range 23–55). Six participants identified as Asian/Pacific Islander, six as White/Caucasian, and three as multiracial.

Scenario-Based Design Sessions. The two activities in scenario-based design sessions were to review previous scenarios and create new scenarios. Participants worked in groups of 2–4 for both activities; there were three groups in total. After receiving an overview of the research and instructions, the groups reviewed and added to the previous scenarios' claims and claim analysis. For the second activity, they worked in the same groups to brainstorm designs based off claims from the previous scenario, draft a new scenario using those designs, and then extract and analyze claims. The inputs and outputs for each type of scenario are listed in Table 1.

For the first activity, participants identified claims by reviewing the scenario for design features that had an impact on the actors, interactions, technology, etc. The claims analysis consisted of identifying the pros and cons of each claim. The purpose of this was to assess the designs in the context and against the requirements detailed in the scenarios. While these pros and cons were not all rooted in scientific processes, they used speculation based off the inputs shared at the beginning of the session. Participants were also provided with several inputs based off appointment indicators from previous research to inform their claims analyses.

For the second activity, participants were told to spend a few minutes brainstorming ideas for the features of the scenario on which they were working. The brainstorming was informed by the background/literature review given by the facilitator, along with the claims and claims analysis that they evaluated in the previous activity. They then wrote the details of those features into the scenario. It is important to note that instead of writing an entirely new scenario, they added on to the previous scenario, focusing on the type (activity, information, interaction).

After creating the scenarios, participants extracted and analyzed claims for their newly adapted scenario, similarly to the first activity. Each session produced three scenarios with their respective claims and claims analysis.

Problem Scenario. Prior to the sessions, a problem scenario and claims were developed by the authors using the data from the previously conducted workshop. This scenario acted as the basis for the first round of scenarios, setting the scene and helping the participants understand the problem. Below is this scenario that was presented to the participants at the beginning of each session. Each of the claims is preceded by a + or – symbol; the + representing a positive claim and the – representing a negative claim.

Scenario Text

Dr. Nan recently finished her residency as a primary care physician and is working at a clinic in Chicago. She loves her job and feels it is important, but it is a difficult job.

She often feels exhausted after a day of patients. She enjoys visits with her patients, but sometimes they come in agitated or uncommunicative. Or, sometimes visits start out well, but then turn sour. It can be difficult for her to feel patient and empathetic at times.

Just an hour ago, she met with a patient experiencing a persistent chronic illness that she hoped to help alleviate. However, she had trouble connecting with this patient and she isn't sure why. She felt she wasn't able to help her patient as well as she could have. When the visit ended, she felt discouraged that her patient was still suffering. She was also left wondering what she did wrong, or how she could have tried to communicate with the patient differently. The clinic she works for collects surveys from patients that they summarize for their physicians, but that sort of feedback is only marginally helpful since she often receives it weeks after a visit has ended and it doesn't include specifics on that visit, just overall impressions.

Unfortunately, the patient was unwilling to schedule a new appointment, and never came back in. To add to that, Dr. Nan continued to worry about this patient in addition to the increasingly long hours in the evenings she was spending catching up on paperwork. This left her exhausted each following day, which started making it more and more difficult to empathize with and focus on her patients. Eventually, she wasn't able to cope with the exhaustion and lack of connection with her patients and left the practice.

Claim 1: Feedback is Received in Survey Form

+Physician can review on own time
+Doesn't take up physician or patient time during appt
+Allows for trends in common physician behaviors or incidents to be highlighted from combining feedback from multiple patients
−Summary doesn't highlight individual interactions or incidents
−Feedback may be received long after a particular interaction or incident, which doesn't allow physicians to correct negative interactions while they occur

Claim 2: Feedback is Received Directly from Patients

+Patients can describe experiences and emotions in their own words
+Patients can describe their individual visit with their provider
−Patient feedback may be critical, but not constructive
−Specific behaviors or types of interactions may be difficult for patients to recall and articulate
−Feedback may not provide evidence-based guidance on how to correct negative behaviors
−Patients may not have time to or want to take the time to fill out surveys

Data Collection During Sessions. Sessions were conducted on web conferencing software Zoom and recorded with participants' permission. Each session lasted around 90

min. A shared online document was used to facilitate and record the scenarios and analyses for each group. Artifacts from the session included the scenarios, claims, and claims analyses.

The video conferencing software Zoom was used as the primary platform for hosting the sessions. This software has the advantage of sharing screens, supporting many participants, and it has the option for breakout rooms for participants to work in smaller groups and hold conversations.

Other resources included the use of Google Docs, a product of Google Drive. This allowed participants to work collaboratively in a single document. Participants could input and edit text at the same time, along with adding images or other materials as needed.

3 Results

Three unique concepts emerged from the SBD process: 1) haptic wearable device 2) color-based visual system on computer screens, and 3) post-visit summary. The first two concepts detailed continuous real-time feedback during patient visits, and the third provided feedback after visits. The claims process resulted in evaluations and changes from one session to the next, keeping concepts aligned with the clinical workflow context from provider perspectives.

3.1 Haptic Wearable Device

The scenarios descripting this feedback tool centered on a wearable that provides haptic feedback to the physician during patient visits. This device provides silent feedback as to not distract the patient. This concept has data being collected and analyzed throughout the visit, feeding the physician input through simple haptic nudges. The highlights of this concept include a visit reminder, feedback on talking balance, and a data portal to review feedback previously given.

3.2 Color-Based Visual System on Computer Screens

Similarly to the previous scenario, this device also provides feedback continuously throughout the visit. However, this concept provides visual feedback instead of haptic, showing color changes on the physician's computer screen as the format of feedback. The purpose of this type of feedback is also to provide it in a way that the patient would not detect or be distracted by the feedback. In both this concept and the one previously, the physician would be able to seamlessly make corrections to their interactions and communication with the patient for improvement.

3.3 Post-visit Summary

The scenarios describing this concept are a departure from the previous two, detailing a visual and text-based summary accessed by the physician after their visit with the patient

has ended. This concept is more traditional, analyzing and sharing the data collected throughout the visit in the form of graphs and text summaries that highlight needs for improvement in the physician's encounters with their patients. It also allows for long- and short- term comparisons to see changes over time.

4 Discussion

Three adaptations were implemented given the circumstances of holding multiple sessions to write and assess the scenarios. These adaptations included: 1) informing scenarios with clinician input from a design workshop, 2) recruiting designers as participants, and 3) proving relevant information to participants during the sessions.

4.1 Informing Scenarios with Clinician Input from a Design Workshop

Prior to conducting the scenario-writing sessions, we held a design workshop where we had access to clinical participants (residents in a family medicine program). The purpose of this design workshop was to understand current and desired experiences in receiving feedback on their work and interacting with patients and other clinical staff. The workshop consisted of two activities where participants worked in groups to imagine different concepts given their preferences for feedback. These activities included a prompt exercise to understand how they currently receive and want to receive feedback, a journey map to illustrate a timeline of their typical days and weeks, and paper prototyping to brainstorm concepts (Loomis and Montague 2021).

After the workshop, we qualitatively analyzed the data for common themes using open coding techniques. These themes and concepts generated in the workshop directly impacted the creation of the problem scenario. There are many qualitative and quantitative studies that detail physicians' experiences, barriers, and the nature of their work, but directly collecting this data with an eye specifically to creating a novel feedback system was a significant advantage to informing the scenario writing sessions. These clinicians did not participate in writing the scenarios and assessing the claims, but the analytical techniques in the design workshop allowed for their experiences and input to inform the scenarios.

4.2 Recruiting Designers as Participants

Considering the difficulty of conducting research in clinical settings and recruiting clinicians as participants, students in the design and HCI programs at the university were the primary participants in the three scenario-writing sessions. While unable to reference clinical experiences, these participants were able to provide their own unique expertise in design. Understanding the process and rationale to design and iteration is challenging, so having this expertise in a short time period through virtual means might have made it more difficult for those without human-centered design experience.

There are also some ways that being solely in a clinical mindset may make it difficult to imagine completely new concepts. When the resident participants in the design workshop were instructed to create prototypes of a new type of feedback system, they quickly

caught on to the idea of brainstorming concepts in groups and creating paper models of them. However, their prototypes were all slight variations of current and common ways of providing feedback to providers. While their designs and the following discussions provided further insight into how they wanted to receive feedback, their prototypes didn't actually reflect those desires (Loomis and Montague 2021). The lack of extensive experience in clinical settings may have been an advantage in this sense; participants in the scenario-writing sessions came up with concepts that hadn't been seen in physician offices before. The HCI and design participants had the advantage of familiarity with design methods, brainstorming techniques, an eye for novel and creative applications of technology, and considerations when interacting with technology aided in creating well thought out concepts.

While the participants did not have experience as providers, they likely had experience as patients. Primary care as a setting and field did not need to be described to participants. This can have positive implications as familiarity with primary care settings can still inform designs in a way that are appropriate for the settings. However, it is also possible their experiences as patients may have influenced their designs, creating concepts or features that physicians would not be comfortable with, that would not work with their workflow, or would not be appropriate in a clinical setting. These are features that only those who work in a clinical setting may recognize.

In future research, as we develop prototypes, we plan to attempt to recruit clinicians for feedback on the designs to ensure that they are feasible, usable, and desirable. Due to the success of including design and HCI participants in understanding the scenario writing and claim assessment processes, it may be helpful in the future to continue including them. We also recommend trying to recruit and pair subject matter experts in the relevant field with those that have design experience under similar circumstances.

4.3 Providing Contextual Information to Participants for the Design Sessions

The primarily design and HCI-focused participants meant that experience as a clinical provider did not inform their designs. Therefore, we started each session with the research objectives, brief background, and summary of findings from the previous design workshop. Reviewing this information with the participants provided them with insights to add to their experiences as patients to inform design choices in the scenarios. Having conducted and analyzed the previous design workshop with medical residents allowed for evidence-supported inputs to be presented to the non-clinical participants to direct their writing of the activity, information, and interaction scenarios.

These participants were introduced the goals, rationale, and clinical considerations at the beginning of each session, but we had to keep this section short due to time constraints. To help participants process and remember information, we provided each group with a link to the slides during the activities. Normally, during in-person sessions, we provide printouts or information on a projector screen to guide participants during activities. These three sessions were all conducted remotely, and participants worked on each activity in Zoom breakout rooms; this constraint prevented participants from seeing the background information and activity instructions previous shared in the main Zoom room. Providing them with individual access to the materials allowed them to review the considerations while they were writing the scenarios and claims analyses.

Despite this access, it is still possible that participants experienced information overload, as the literature and findings presented were dense and may have been primarily new knowledge. This is a difficult situation to mitigate. Simplifying the information as much as possible, scheduling in time for questions, and allowing extra time during activities to process information and activity instructions. If possible, recruiting additional facilitators with subject-matter knowledge to participate in each breakout room could help clarify findings or background information, in addition to helping participants stay on track.

5 Conclusions

Applying and adapting scenario-based design resulted in three thoughtful and unique concepts. While nearly all participants lacked experiences as clinical providers, we adapted the methods to help make sure that the scenarios were properly informed by clinician's desires and needs for a feedback tool. We accomplished this through incorporating findings from previous workshops with clinicians, recruiting participants with design experience, and providing the participants with information to direct and inform their concepts. As this was one piece in the process of designing and evaluating the feedback tool, next steps include further prototyping and user testing with designers and clinicians.

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