

# What Physicians and Patients Expect from Digital Agents for Consultations: A Qualitative Study

Andri Färber, Christiane Schwabe, Philipp H. Stalder, Mateusz Dolata, Gerhard Schwabe

Submitted to: JMIR Human Factors  
on: June 04, 2023

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Table of Contents

Original Manuscript..... 4

Supplementary Files..... 29

    CONSORT (or other) checklists..... 30

    CONSORT (or other) checklist 0..... 30

# What Physicians and Patients Expect from Digital Agents for Consultations: A Qualitative Study

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## Abstract

**Background:** Physicians are overwhelmed by administrative tasks and spend too little time counseling patients, hampering health literacy, shared decision-making, and adherence to treatment.

**Objective:** Do digital agents built on fast-evolving generative AI, such as ChatGPT, have the potential to improve healthcare counseling? We sought answers by asking patients and physicians for their opinions on the description of three digital agents, a Silent Digital Expert, a Communicative Digital Expert, and a Digital Companion.

**Methods:** Our exploratory study conducted in-depth interviews with 25 patients and 22 physicians from a convenience sample. The patients and physicians were from a wide age range and came from different educational backgrounds or medical fields. All interviews were audio recorded and transcribed. The transcripts were deductively coded using MAXQDA and then summarized by code and interview. The resulting summaries were then clustered for interpretation.

**Results:** We structured statements and quotes from patients and physicians according to three consultation phases: First: Silent and Communicative Digital Experts who support and are part of the consultation; second: Digital Experts who hand over to a Digital Companion for the time between consultations; third: Digital Companions supporting patients between consultations. Overall, patients and physicians were open to this kind of counseling support but expressed thoughtful concerns about various details across all digital agents.

**Conclusions:** Considering the results and linking them to the literature, we derived nine requirements for designing digital agents to support counseling.

(JMIR Preprints 04/06/2023:49647)

DOI: <https://doi.org/10.2196/preprints.49647>

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## Original Manuscript

## Original Paper

# What Physicians and Patients Expect from Digital Agents for Consultations: A Qualitative Study

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**Keywords:** adherence to treatment; digital agents; eHealth; electronic medical records; health literacy; mHealth.

## Abstract

**Background:** Physicians are currently overwhelmed by administrative tasks and spend too little time in consultations with patients, which hampers health literacy, shared decision-making, and treatment adherence.

**Objective:** Do digital agents constructed using fast-evolving generative AI, such as ChatGPT, have the potential to improve consultations, adherence to treatment, and health literacy. Patients and physicians were interviewed for their opinions of three digital agents – a silent digital expert, a communicative digital expert, and a digital companion.

**Methods:** We conducted in-depth interviews with 25 patients and 22 physicians from a purposeful sample, the patients having a wide age range and coming from different educational backgrounds, and the physicians having differing medical specialties. Transcripts of the interviews were deductively coded using MAXQDA and then summarized according to code and interview before being clustered for interpretation.

**Results:** Statements from patients and physicians were structured according to three consultation phases: (a) silent and communicative digital experts that are part of the consultation; (b) digital experts that hand over to a digital companion between consultations; and (c) digital companions that support patients between consultations. Overall, patients and physicians were open to these forms of digital support but had reservations about all three agents.

**Conclusions:** Ultimately, we derived nine requirements for designing digital agents to support consultations, treatment adherence, and health literacy based on the literature and our qualitative findings.

## Introduction

Consultations are less productive than physicians and patients would wish [1,2], which hampers health literacy, shared decision-making, and treatment adherence. The recent rise of generative AI, such as ChatGPT, has sparked the interest of digital health developers as they explore how this technology can improve shared decision-making, physician-patient communication, adherence to

treatment, and health literacy. In this paper, we seek to discover what physicians and patients expect from digital agents (functional requirements) and how this functionality should be provided (non-functional requirements). A user-centric perspective is essential for guiding the development of digital agents since it prepares physicians for changes in their consultation methods and patients to understand what the new technology can offer.

Through in-depth interviews (see “Methodology”), we described three digital agents to physicians and patients, analyzed their impressions and expectations (see “Results”), and deduced a set of design requirements (see “Discussion”). An introduction to the research background for three different digital agents precedes these sections.

## Research Background

### *Relevant Medical Concepts*

Four medical concepts are essential when supporting medical consultations with digital agents: (a) shared decision-making, (b) physician-patient communication, (c) adherence to treatment, and (d) health literacy.

Consultations involve a participatory process between patients and physicians to reach agreement on treatment goals and their implementation [3,4]. **Shared decision-making** has emerged as the gold standard for this participatory process [5–10] as it strives to reach a mutual agreement about therapy [6,7]. However, a systematic review of shared decision-making in clinical decisions found that humanistic aspects of physician-patient communication were rarely assessed [11]. Good **physician-patient communication** is not just about technique or process. It also involves understanding the whole person, finding common ground, and enhancing the patient-physician relationship [4]. In this way, physician-patient communication can have a therapeutic effect and influence health benefits [12].

Of course, the therapeutic process continues after the patient has left the consultation [3]. Once at home, it is up to the patient to implement the therapy plan, and the extent to which this happens is referred to as **adherence to treatment** [13]. Adherence focuses on patients taking responsibility for their treatment and physicians collaborating more with their patients [14,15]. However, despite some progress, adherence to a treatment plan remains insufficient [13,16–18]. One reason is a lack of **health literacy** when following the instructions given. Doctors may explain medical issues and treatment options during consultations, but their time is limited, and they must convey as much information as possible. Second, patients are in a stressful situation, which restricts how much they can absorb and hinders their recall [19–24]. Third, physicians may use medical terminology [25] with the following consequences: Patients either do not understand or quickly forget what was discussed [26,27]. Brochures and leaflets are typically used to support health literacy, and modern approaches include video/multimedia, computer-assisted learning/mobile apps, and other online aids [28–32].

### *Digital Agents*

Digital agents are computers that undertake tasks previously carried out by humans. As such, they function autonomously, react to environmental situations, initiate actions, communicate with humans or machines, and behave intelligently [33]. An increasing volume of digitized data, improved algorithms, and better hardware has vastly enhanced the range of tasks that digital agents can perform. The most noticeable aspect is the recent success of generative AI. Nevertheless, the expanding capabilities of digital agents also raise concerns about AI in general and digital agents in

particular [34]. Examples include their potential misuse, how they can be controlled, and whether they exhibit bias [35]. Besides these general concerns, researchers are interested in exactly how digital agents interact with humans. While human-like behavior may be helpful in some situations, task performance may be impeded by too much humanness [36,37] in situations where humans prefer a digital agent with a background function. This issue is critical in institutional settings [38], where professionalism is vital.

Discussion of the capabilities of digital agents and their suitability has also reached the medical domain [33,39,40]. Conceptually, the dyadic physician-patient consultation becomes triadic [41–44] if a digital agent is included. The presence of digital agents changes consultation dynamics [45,46] and alters how patients and physicians behave [41]. Despite such insights, the discussion lacks a clear conceptualization of the digital agent's role in the professional context of physician-patient consultation. Consequently, discussing what physicians and patients expect from digital agents during and between consultations has not been possible.

### ***Current Digital Support for Consultation, Adherence to Treatment, and Health Literacy***

Physicians use electronic medical records and encounter patient decision aids during consultations, giving patients access to their data through patient portals. Patients may also store data in their personal health records and take advantage of mHealth apps between sessions.

*Electronic medical records (EMRs)* support physicians in documenting medical history, including physical examinations and laboratory results. They are intended to save costs, improve patient safety, increase efficiency [47], and safeguard data [48,49]. Since EMRs are designed primarily for documentation purposes [50], it has been left to physicians to determine how to use them in patient interactions. Proper use of EMRs by trained healthcare professionals can improve health literacy and adherence to treatment compared to paper-based records [51], for example, if physicians share their EMR screens with patients during consultations [52,53]. However, when used ineptly, doctors lose control of consultation through increased gaze shifts and multitasking and are hindered in their medical reasoning [47,54]. In the presence of a computer, pre-existing positive and negative communication skills are amplified [55,56].

*Encounter patient decision aids (ePDAs)* support physician-patient consultations by providing decision-related information and choices [57–61]. Although they tend to be simple in design [61], physicians complain that lack of training and experience and insufficient content and format impede meaningful ePDA use [57,58]. Another challenge is keeping ePDAs updated with the latest information [60].

*Patient portals* give patients access to their data stored in EMRs [62]. In such tethered patient portals, the responsibility for maintaining the data lies with the physician. To be understood by patients, information from EMRs must be translated [62], and this applies to language as well as graphs and other multimedia material.

Unlike patient portals, in (electronic) *personal health records (PHRs)*, patients themselves enter and maintain their health data [63]. While PHRs can accumulate more information than patient portals, quality control and manageability are challenging. There is a consensus that more is needed to enhance health outcomes or treatment adherence than just patient access to their data [64,65]. Better-informed patients are not necessarily healthier patients [64], but there is (a) value and (b) potential in patient portals and PHRs. First, patients want access to their data to review it again at home, discuss

it with their families, and use it as a starting point for further online research [62,64]. Second, there is evidence that patient portals and PHRs are more effective when they are interactive, combined with other services such as reminders or interactive decision support, and when physicians actively promote their use [62,64].

Digital interventions based on *mHealth apps* promise to support patients' health literacy and adherence to treatment. In 2017, more than 300,000 health apps were available in online app stores [66]. Not all are considered effective, convenient, or high quality [67–69], and many have low success and high dropout rates [70–72]. Nevertheless, despite their shortcomings, mHealth apps appear to support patients in treatment adherence effectively [67,73,74]. If they pass medical quality gateways, they can even be prescribed the same way as medicine [75,76]. Physicians are best placed to assist their use, but this requires their integration into workflows and EMRs [74,77,78], and the security of patient data must be guaranteed [79].

### ***Digital Agents to Support Consultation, Adherence to Treatment, and Health Literacy***

We conceptualized three general roles for digital health agents, which tie together modern medical concepts and earlier work on digital agents with current digital support for consultation, adherence to treatment, and health literacy. These served as a basis for our empirical work, when introducing our selected physicians and patients to digital agents.

A digital agent can be a 'digital expert' providing the right aids at the right time or offering a second opinion about diagnosis and treatment. It can stay in the background of the consultation as a '*silent digital expert*' or actively participate in the consultation as a '*communicative digital expert*.' Alternatively, it can be a '*digital companion*,' supporting the patient between consultations. Digital companions provide patients with comprehensible information about diagnosis and ongoing treatment.

*Silent digital expert:* This is an extension of the EMR, providing the physician with contextual and real-time advice and additional information. The silent digital expert is designed to free the physician from searching vast information sources and allows more time for face-to-face consultation, thereby improving physician-patient communication [4,12]. For example, the silent digital agent can alert physicians to different diagnoses and drug interactions or offer prompts for further questions. The silent digital agent also supports diagnosis and suggests appropriate treatment in a shared decision-making process [5–10]. As an aid to the physician, it is visible and accessible only to the physician, and with patient consent, it can record, transcribe, analyze, and summarize the consultation.

*Communicative digital expert:* As the third party in a triadic consultation, the communicative digital expert offers the same functionality as the silent digital expert. However, it also actively participates in the consultation by extending the functionality of EMRs and ePDAs through an agency. It may be physically represented as a human-like robot, a smart speaker, or device of any shape. As the third party, the communicative digital expert can be invited to comment on the decision process by physicians or patients [5–10] and become active in explaining medical topics, thereby improving health literacy [80–83]. As such, it can be considered a physician's assistant or advocate for the patient, improving physician-patient communication [4,12]. For example, it might interrupt the dialogue if a doctor is too brief or dominant, providing both parties with further information, diagnosis considerations, and treatment recommendations. It acts in an empathetic, patient-centered way and is capable of identifying and taking patient preferences into account.

*Digital companion:* This agent is intended to support patients *between* consultations by extending patient portals and PHRs and combining them with an mHealth app. It relies on data from the EMR and supports patient treatment behavior. Its primary goals are to improve the recall of recommendations and information, promote health literacy [80–83], and support treatment adherence [12–18,84]. The digital companion captures the critical points of the physician-patient consultation, translates them into everyday language, enriches them with multimedia elements (audio, pictures, diagrams, video), and makes them conveniently accessible to patients or their families at any time. It also provides the patient with curated additional information and interactively supports their healthcare education based on individual preferences. Using sensor data from various devices (e.g., smartphones, smartwatches, pedometers, blood glucose monitors, etc.) as well as patient interaction with the digital companion, adherence to the treatment plan is measured, analyzed, and fed back to the patient (and, with the patient's consent, to the physician). The digital companion provides context-specific adaptive interventions [85–88] based on adherence measurement, an individual treatment agreement, and patient preferences. For example, adherence support might include diet recipes, exercise instructions, morale-boosting talks, and more.

## Methodology

### Research Approach

This study aims to understand what physicians and patients require from digital agents. These requirements should be grounded not only in technical vision but also in current consultation practices and with a focus on problem-solving.

Our research approach is inspired by the practice-oriented approach popular in computer-supported cooperative work (CSCW). CSCW is an interdisciplinary field of research involving, among others, computer science, psychology, and sociology to analyze the potential and the shortcomings of digital assistance in consultations [89–91]. CSCW mainly uses qualitative methods and focuses on how human collaboration can be supported by technical means [89,92]. As these means must be applied within a professional context, this also involves studying work practices from the perspective of those involved [93,94].

Our study embraces this tradition by following an exploratory paradigm, striving for deep, contextualized insights [95,96]. We conducted an interview-based qualitative study with 47 participants – 22 physicians and 25 patients. Our analysis combined bottom-up thematic analysis and interpretive research, allowing for both broad coverage and deep insight.

Overall, the chosen methodological approach respected the need to understand patient and physician perspectives regarding their work practices and the potential use of technologies. We addressed variation and triangulation, whereby multiple researchers conducted the interviews and covered different patients and physicians. We ensured audit throughout the process by mutual control between researchers and assigning a quality manager role to one of the authors. The first author was directly engaged in data collection during a preliminary study [97] and guided data collection during this study to ensure adequate engagement in data collection activities. In sum, the study employed various strategies to ensure the reliability and validity of the presented results [98] and followed COREQ guidance for reporting research [99].

## Ethics

The Canton of Zurich Ethics Committee confirmed that this study was not subject to the Swiss

Human Research Act (BASEC-Nr. Req-2018-00847). Nevertheless, written informed consent was obtained from all participants before their interviews according to the WMA Declaration of Helsinki [100].

## Sampling and Recruitment

Exploratory studies require a variety of opinions, but they do not seek to be representative. To ensure variety, we interviewed both physicians and patients. We also relied on purposive sampling using a maximum variation strategy [101], which allowed us to search for a broad range of physicians and patients. Given that five interviewers acquired the patients and physicians independently, we can assume coverage to be even better than strategies involving sampling through a single researcher.

Table 1: Demographic data of the interviewed physicians and patients

|           | Physicians (n=22)  | Patients (n=25)    |
|-----------|--------------------|--------------------|
| Gender    | 12 male, 10 female | 14 male, 11 female |
| Age range | 25 - 66            | 20 - 86            |
| Age mean  | 50                 | 46                 |

Thirteen out of 22 physicians are active in primary care, and the others work in hospitals; 11 are general practitioners or specialize in internal medicine. Other specializations include pediatrics, gynecology, radio-oncology, and dentistry. The educational background of the 25 patients ranged from unskilled workers to professionals and academics. The patients presented a broad spectrum of conditions, including diabetes, multiple sclerosis, heart conditions, tick-borne encephalitis, and epilepsy.

We conducted 46 in-depth interviews that resulted in audio recordings with 32 hours of interview time, amounting to an average length of 42 minutes and 46 seconds with a standard deviation of 13 minutes and 47 seconds. Forty-five interviews were held with one interviewee per session, and one involved two respondents. The sample size assured data saturation – the topics emerging in the interviews overlapped after about 18-20 interviews for each group [102]. In line with the practice for purposive sampling/maximum variation [101], we used various channels to establish the initial contact with the interviewees (e-mail, face-to-face, and telephone). After confirming the time and date for a potential interview and giving their consent, no one dropped out of the study.

## Data Collection

Five researchers conducted in-depth interviews based on the respective interview guides – one for patients and one for physicians [96]. The interview guides were developed based on the literature on physician-patient communication, adherence to treatment, existing solutions in the field of medical informatics, and the authors' own experiences in the medical domain, including their research background. The overall structure of the interviews was informed by CSCW practice-oriented studies [93,94]. The interview guides were pre-tested in a preliminary study with 11 HCPs and seven patients published elsewhere [97]. Interviews for the current study were conducted between January and May 2019, with patient interviews taking place mostly in their homes and HCPs in their professional context. Before the interviews, all researchers underwent interview training sessions to ensure they had the same understanding of the questions and knew how to conduct the interview. The interviews were structured around three areas: current situation/practice (format and preparation for a consultation), future developments (expectations and attitudes toward digital healthcare), and closure

(other points not already covered).

When discussing digital developments, we suggested potential ideas since users often lack the necessary imagination when asked about future products or services [103]. Nevertheless, when prompted, many users can express helpful subjective opinions on specific ideas. Therefore, in the spirit of design thinking [104], we exposed users to key design ideas by describing digital experts and the digital companion and asking for their perceptions, expectations, and preferences regarding digital agent support. As typical in design thinking, the discussion focused on the desirability of critical capabilities but did not go into a detailed discussion about feasibility.

## Data Analysis

All the interviews were audio recorded and transcribed. The analysis combined deductive thematic and interpretive research, allowing for broad coverage and deep insight simultaneously. During the top-down analysis, the transcripts were coded according to a codebook derived inductively from a smaller preliminary study [97]. A professor of nursing science cross-checked the codebook. Again, all researchers went through a training session to ensure they had the same understanding of the codebook. All interviews were then deductively coded using MAXQDA [105]. The designated quality manager conducted quality assurance, controlling all code assignments and correcting them to ensure a consistent basis for analysis. We achieved thematic saturation – all themes from the specified coding schema appeared in the data with high frequency (the most frequent code was assigned 274 times, the least frequent 25 times; overall, we had 1,954 code assignments for all codes) [102]. Finally, all interviews were summarized by code; for each theme, we obtained a summary of participant opinions related to this code. These summaries formed the basis for further analysis, and the results were then used for interpretation.

To interpret the data, we organized two interpretation workshops involving the authors. The workshops aimed to establish a shared and consistent understanding of the most essential insights between the authors. The interpretive process involved iterative restructuration of the summaries along various dimensions, with two dimensions emerging as crucial for forming a consistent data view. First, we differentiated between problems, current practices that emerged to mitigate those problems, and potential technological solutions to address those problems that occurred during the interviews. Second, we observed that the issues aligned with the phases of a patient's journey, starting with (a) the consultation, (b) the *transition* between consultation and the period between consultations, and (c) the actual period between consultations. Those differentiations provide the framework for reporting our results, while the proposed structure covered all challenges and problems identified during coding.

In our representation of the results, we refer to the frequency of specific challenges since, after identifying the framework and distributing the significant challenges for each, we returned to the coded data to classify the coded passages. Below, we present the quantified data about the frequency of passages pertaining to the challenges. However, we must stress we make no claim regarding the representativeness of these figures, as the analyzed population was not selected to be representative of the wider population. Instead, the numbers ensured the thematic saturation mentioned earlier.

## Results

The analysis assigned the results to three steps in the patient journey: First, the consultation, then incorporating information from the consultation into their lives, and finally, the time between consultations.

## Problems and Agent-Based Solutions During a Consultation

During the consultation, the main challenge, according to physicians and patients, is passing on complex information in minimal time to laypersons with various backgrounds, expectations, and abilities while building or maintaining a relationship of trust. Table 2 summarizes the problems voiced by physicians and patients, current practices (as presented by the interview partners), and envisioned solutions offered by the two different versions of digital expert.

Table 2: Problems and solutions suggested during a consultation. The figures refer to the number of mentions in interviews. (phy = physician, pat = patient)

| <i>Problems during the consultation</i>                                                                          | <i>Current practices</i>                                                                                                                                                                                                                  | <i>Solutions offered by the silent digital experts</i>                                                                                                                                                                             | <i>Solutions offered by communicating digital experts</i>                                                                                 |
|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Time pressures (phy: 5, pat:3)                                                                                   |                                                                                                                                                                                                                                           | Physicians can concentrate on a thorough and engaging consultation using digital situational information.                                                                                                                          | Ditto.                                                                                                                                    |
| Medical information is complex. (phy: 9, pat: 18).                                                               | Physicians... <ul style="list-style-type: none"> <li>• use graphics, visualizations, videos, and 3D models from brochures, books, and online (phy: 14, pat: 7), or</li> <li>• draw illustrations themselves (phy: 13, pat: 4).</li> </ul> | The digital expert provides physicians with... <ul style="list-style-type: none"> <li>• the right visual aid at the right time</li> <li>• graphic templates or blank drawing areas they can use for their own drawings.</li> </ul> | The digital expert suggests texts, images, audio, and video resources tailored to individual patient needs.                               |
| Not all patients respond to medical advice and information in the same way (phy: 12, pat: no matching question). | Most physicians try to approach patients individually by adapting their language to a patient's educational background or medical knowledge (phy: 4, pat: no matching question).                                                          | The digital expert provides visual aids tailored to a patient's educational background, numerical ability, or language skills.                                                                                                     | The digital expert intervenes if it determines (e.g., through sentiment analysis [106]) that a patient does not understand the physician. |
| Patients expect more transparency and control over the                                                           | Many patients engage in conversations with                                                                                                                                                                                                |                                                                                                                                                                                                                                    | The digital expert intervenes when physicians do not                                                                                      |

|                                                                                                                          |                                                                                                                                                                                                                       |                                                                                                                                                                                                           |                                                                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| treatment process (phy: 2, pat: 21).                                                                                     | physicians and take responsibility for their treatment (pat: 3); physicians try to support this (phy: 4, pat: 5).                                                                                                     |                                                                                                                                                                                                           | give their patients enough time to talk, and it can empower patients to take more control.                                                                                                     |
| Some patients do not agree with the proposed treatment plan (phy: 4, pat: 6).                                            | Physicians... <ul style="list-style-type: none"> <li>• respond with more intensive explanations, (phy: 8)</li> <li>• protect themselves by documenting the conversation, or</li> <li>• just let it happen.</li> </ul> | The digital expert offers arguments, statistics, and figures to support the physician's point of view.                                                                                                    | The digital expert advocates for the patient (by putting the physician's thoughts or guidelines into perspective) or for the physician (by supporting the physician's thoughts or guidelines). |
| The computer distracts the physician and interrupts communication. Computer use amplifies inferior communication skills. |                                                                                                                                                                                                                       | The user interface of the digital expert is designed to be self-explanatory and user-friendly. Rather than the physician, the digital expert searches for information and offers context-related content. | The digital expert supports the physician and the patient, e.g., through active listening. It will only interfere by assisting an already impaired conversation.                               |

Regarding current practices, patients and physicians report that there is too little time for a thorough and engaging conversation: *"I just felt like I was being processed. Quick assessment with the question: What's the problem? And I felt that I couldn't even say what I had because it was already clear to the physician. After a quarter of an hour, I was out of there again, and I was no wiser"* (male patient, age 60, [D07]<sup>1</sup>). *"I frequently make lifestyle recommendations. Costs time too, by the way, cannot be done in a 20-minute consultation that's just long enough for issuing a prescription"* (male general practitioner, age 64, hospital [ST09]).

Most physicians in this sample practice shared decision-making. Some use the explicit term during the interview; others behave accordingly: *"Then I say, we could try pharmacy, we could try herbs, we could try acupuncture or this or that. I'll let the patient have a say. Because then the patient's adherence is also much better"* (female general practitioner, age 65, medical office [MA10]).

All interviewed patients favored a silent digital expert as an aid to the physician; nor do they object to physicians using online sources to obtain additional information during a consultation: *"I don't like having a doctor who introduces him- or herself as 'I am the all-knowing one.' For me, that tends*

<sup>1</sup> The IDs are unique and identify a specific interview. The prefix consisting of one or two letters identifies the interviewer, whereas the number identifies the specific interview by the interviewee.

*to inspire confidence when a physician says: I don't know, I have to work with the exclusion procedure"* (male patient, age 74, [F01]).

However, patients expect uninterrupted attention, for which a sufficiently high level of expertise by the physician in using the computer is an essential prerequisite: *"He kept asking and reading to me while he was writing and asking me if that was correct. This was great for me because then I knew what he was writing"* (female patient, age 52, [S10]).

Most physicians in this study would welcome a silent digital expert to facilitate multitasking, and some already use drug interaction assistants or risk/score calculators: *"You can't read through the books in the evening. That would mean an insane amount of time or such a head. That's why these are important tools, I think for rare conditions it's certainly a good idea"* (female gynecologist in a hospital, age 35, [MA02]). However, the benefits of a digital expert are assessed differently by those in different medical disciplines. One physician was concerned about a transfer of responsibility to the digital expert, while another worried about a decline in interprofessional communication. A young physician was concerned that this would cause her to acquire too little experience and self-confidence: *"You rely too firmly on that afterward. Then you believe too firmly in that. Then it takes over your task, so to speak"* (female dentist, age 29, dental surgery [MA03]).

The majority of patients in this sample view communicative digital experts positively. Those against them are concerned that they might be disruptive or could be manipulated by the physician: *"I do not know what the physician can enter there, and then it is clear that the computer represents the opinion of the physician"* (female patient, age 51, [S07]). The opinions of those in favor of it differ. Some see a communicative digital expert as helping less skillful physicians, and others competent ones. Some would like a digital expert to be a physician's assistant, while others see it as a patient's advocate: *"As a patient, you are always subordinate to the physician, in that sense. I don't think it's a bad thing when someone else is on my side"* (female patient, age 28, [S06]).

About two-thirds of the physicians interviewed reject the communicative digital expert. For them, credibility, decision-making authority, and their patients' trust are at stake. Some see empathy between physician and patient as essential for patient adherence to treatment and, therefore, do not believe a digital expert can help. One physician found communicative digital experts annoying but assumed physicians and patients would get used to them over time. *"In principle, I say, there is still an interpersonal level that artificial intelligence cannot comprehend"* (female general practitioner, age 48, medical office [MA08]).

## Problems and Agent-Based Solutions for Transitioning from Consultations to the Period Between Consultations

Problems during the consultation may also hinder treatment because poor consultations can impair health literacy and adherence to treatment. Table 3 provides an overview of voiced consultation issues afflicting the time between consultations and envisioned solutions offered by an interaction of the digital expert and the digital companion.

Table 3: Problems and envisioned solutions for transitioning from consultations to the period between consultations. The figures indicate the number of mentions in the interviews. (phy = physician, pat = patient)

| <i>Problems resulting from the consultation</i> | <i>Current practices</i> | <i>Solutions offered by the digital experts connecting</i> |
|-------------------------------------------------|--------------------------|------------------------------------------------------------|
|-------------------------------------------------|--------------------------|------------------------------------------------------------|

|                                                                                               |                                                                                                                                                                                                                                                                                                                                                                             | <i>to the digital companion</i>                                                                               |
|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| Patients cannot remember everything that the physician says. (phy: 0, pat: 10)                | Patients... <ul style="list-style-type: none"> <li>• bring companions to the consultation</li> <li>• consult brochures or online sources (pat: 2)</li> <li>• use reminders on smartphones (pat: 2)</li> <li>• take notes (pat: 6).</li> </ul> Physicians... <ul style="list-style-type: none"> <li>• repeat (phy: 2)</li> <li>• use active listening techniques.</li> </ul> | The digital expert records, transcribes, and summarizes the conversation for the patient (quality assurance). |
| Identifying and introducing clinically relevant mHealth apps is time-consuming and difficult. | Patients search for apps themselves, but usage dropout rates are high.                                                                                                                                                                                                                                                                                                      | The digital expert suggests quality-assured mHealth apps or equivalent features of the digital companion.     |

Most physicians in this sample see potential in automated recording and transcription. One doctor hoped digital experts would give him more time to communicate with patients. However, physicians doubt that a computer could separate relevant statements from irrelevant ones and find producing relevant summaries challenging. Some physicians stress that the notes they make for themselves on the case cannot be directly shared with the patient but need to be translated. Others insist on control over what information is shared with patients: *“Therefore, the software must either be able to guarantee this or otherwise it is legally difficult to prove that the patient has been informed correctly”* (male radio-oncologist, age 35, hospital [MA01]). Besides technical difficulties, the interviewed physicians see another reason to avoid automatic summaries: Subjective perceptions are often only discussed verbally or communicated by telephone for fear of litigation: *“Certain things, incidents and so on, or special experiences or special stories that are told that could have legal relevance. I don’t list them in the computer”* (male general practitioner, age 62, medical office [ST02]). Another physician takes precisely the opposite position. He would appreciate transcripts of complex consultations in which, for example, child protection discussions or off-label prescriptions of medication are involved. One physician did not believe a consultation’s significant first and last seconds would be transcribed with the necessary weighting.

Patients also have different visions for digital experts: While only a few patients in this study raised data protection concerns, some claimed to benefit from proof of what was said in case of disagreement or malpractice. One patient was worried about a decline in care because physicians were afraid of malpractice lawsuits: *“I tend to think I get worse treatment because most physicians have way too much fear of someone coming in afterward and saying, ‘I’m going to sue you – you told me something wrong’”* (male patient, age 61, [S02]).

## Problems and Agent-Based Solutions Between Consultations

The consultation cannot cover all questions and issues arising between consultation appointments, and patients must rely on their own judgment or a tool that assists them during this period. Table 4 covers problems between consultations that lead to poor adherence, and solutions offered by the digital companion.

Table 4: Problems and envisioned solutions between consultations. The figures indicate the number of mentions in the interviews. (phy = physician, pat = patient)

| <i>Problems between consultations</i>                                                                                                                                                                                                                                                            | <i>Current practices</i>                                                                                                                                                                                                                                                                                                                                                                                                 | <i>Solutions offered by the digital companion (DC)</i>                                                                                                                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Patients lack information because of...</p> <ul style="list-style-type: none"> <li>insufficient time for explanations during the consultation (phy: 5, pat: 3)</li> <li>poor recall of the consultation (phy: 3, Pat: 11)</li> <li>more questions arising later (phy: 0, pat: 11).</li> </ul> | <p>Patients...</p> <ul style="list-style-type: none"> <li>use online sources but are skeptical, and some distrust online forums in particular (phy: 6, pat: 6)</li> <li>read brochures (pat: 3), attend public lectures, or even attend anatomy courses.</li> </ul> <p>Physicians...</p> <ul style="list-style-type: none"> <li>provide brochures to guide patients away from online self-diagnosis (phy: 2).</li> </ul> | <p>The DC provides curated content and weblinks tailored to the patient's diagnosis. This reduces misinformation and false self-diagnosis. In addition, it fosters more trust in healthcare information.</p> |
| <p>Patients lack clear instructions and specific information, but instead suffer from information overload (phy: 0, pat: 8).</p>                                                                                                                                                                 | <p>Physicians provide paper-based instructions regarding medication, exercises, and lifestyle changes (phy: 3, pat: 8).</p>                                                                                                                                                                                                                                                                                              | <p>The DC tailors content to patient preferences, contexts, and specific circumstances. This includes content presentation in different formats (simple/sophisticated text, images, audio, video).</p>       |
| <p>Between consultations, patients are on their own. (phy: 3, pat: 1).</p>                                                                                                                                                                                                                       | <p>Patients report little interaction with their physicians between consultations. Some use e-mail, but only sparingly (phy: 2, pat: 7).</p>                                                                                                                                                                                                                                                                             | <p>The DC provides low-barrier access to the physician between consultations. A chatbot covers part of the conversation to protect physicians from a huge workload.</p>                                      |
| <p>Patients are over-challenged when taking their medication. (phy: 2, pat: 8).</p>                                                                                                                                                                                                              | <p>Medication apps can support complicated medication regimes (phy: 1, pat: 2).</p>                                                                                                                                                                                                                                                                                                                                      | <p>The DC supports adherence by providing the patient with individualized interventions that consider patient preferences, contexts, and specific circumstances.</p>                                         |
| <p>Treatment success or failure goes unnoticed. (phy: 4, pat: 0)</p>                                                                                                                                                                                                                             | <p>Physicians ask patients to keep diaries or journals, mostly on paper (phy: 8, pat: 3).</p>                                                                                                                                                                                                                                                                                                                            | <p>The DC offers easy-to-keep diaries and journals, including data captured from digital devices (e.g., wearables). The collected data can be shared with physicians (with the</p>                           |

|                                   |                                                                                                                          |                                                                       |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
|                                   |                                                                                                                          | patient's consent).                                                   |
| Measuring adherence is difficult. | Adherence is rarely measured and often only based on the purchase of medicines (phy: 1, pat: no corresponding question). | The DC offers adherence measurements in an easy-to-understand format. |

The vast majority of patients in this study would welcome a digital companion, though a small minority are skeptical or undecided. Patients are open to using electronic tools and online services regarding current practices. However, this is not always helpful to physicians: *"People practically come with a diagnosis, and after that, we first have to come back to the symptoms. And I have to say, 'hey, we have to start all over again'"* (male general practitioner, age 66, medical office [ST01]).

Many physicians who were interviewed could see the potential of a digital companion. Some hoped this would improve adherence to medical advice, while one saw a significant benefit in making the digital companion genuinely personalized and tailored to an individual patient's needs. As for monitoring patient behavior between consultations, fewer than one-third of the physicians reported adherence measurement (which is usually based on the purchase of medications): *"That's why I'm very happy when the patients order medication from us because then I can see on the computer when they have picked up their medication. I don't see that when they buy medicines from the pharmacy"* (female general practitioner, age 48, medical office [MA08]).

Most physicians in this sample are open to receiving and interpreting monitoring data from patients and their mobile devices. However, they have the following reservations: First, there is an unmanageable number of mobile apps. Second, they fear monitoring data overload and being forced to respond to monitoring results, requiring additional time that physicians do not have. Third, physicians see a risk that such monitoring will negatively influence patient behavior. One raised the possibility that neurosis could result from constant introspection. Another concern was that patients would abdicate responsibility for their condition by transmitting data and threshold violations. Despite these concerns, confronting patients with threshold violations encourages them to reflect on their condition and possible lifestyle changes. As a result, patients can become "experts" on their condition: *"Because that is certainly one aspect when patients think about it: Why did my sugar do that now? That's the most instructive. And the goal is that they become the 'expert' and I coach them"* (female general practitioner, age 39, hospital [ST08]).

## Discussion

Problems in physician-patient interaction that ultimately hamper treatment adherence fall into three categories: problems concerning the consultation itself, problems from the consultation but appearing between consultations, and new problems arising between consultations. These problems overlap and, therefore, need to be covered by integrated support systems. Based on the scenario, a support system consisting of digital agents assisting in the consultation and a companion for times between consultations is proposed. To qualify for the task, these agents need to meet the expectations of physicians and patients and improve health outcomes. The following paragraphs discuss design recommendations for the three digital agents active in the consultation and as a patient's companion between consultations.

## Requirements for Digital Experts During the Consultation

Digital experts reveal their capabilities during the consultation by integrating and extending the functionality of EMRs and ePDAs, with the characteristics of digital agents [33]. These include

autonomous and intelligent behavior, reactions to environmental situations, and communication with humans or machines.

*1. The digital agent should make its role in the triadic consultation transparent.*

Our interviews asked for opinions about medically skilled digital agents as part of a physician's EMR [45,46]. These can facilitate conversations between physicians and patients or offer second opinions regarding diagnosis and treatment. In such a case, the digital agent functions as an additional physician. Although most patients would welcome this triadic consultation, some fear physicians could manipulate their digital companions. These reservations arise from an understanding that digital agents could adopt the role of a second physician as well as a trusted family member, spouse, or friend [41,42]. Such roles include informational or emotional support (e.g., taking notes, ensuring understanding, and reassuring patients) [42]. Accordingly, the role of a digital agent in consultation must be clearly defined and transparent to patients. Further research might explore what patients require in order to trust and benefit most from these digital agents, whether in the role of a second physician, family member, spouse, or friend.

*2. The digital agent should encourage trust and support the physician-patient relationship while safeguarding physician credibility.*

Literature and the interviews with physicians and patients all agree on the importance of trust and good relationships between physicians and patients in a medical setting [4,12]. While traditional health information technology (e.g., EMRs and ePDAs) does not seem to interfere with patient-physician relationships [53], the situation changes when digital agents act as medical experts or digital companions during a consultation. Most interviewed patients like the idea of a digital agent and do not think it will harm the physician-patient relationship. At the same time, the majority of physicians take an opposing view, fearing loss of credibility and decision-making authority. Therefore, a challenge lies in fostering trust and supporting relationships between physicians and patients instead of undermining them. Such digital agents must support patients but not unduly contradict physicians or disrupt the natural flow of conversation. This means that digital agents must recognize whether a piece of medical advice will strengthen or damage the relationship.

*3. The digital agent should help physicians to focus on the patient during the consultation.*

The interviewed patients expect their physicians' full attention even when interacting with a computer. In a traditional practice setting, computer screens create a barrier between patients and physicians and can be a serious distraction [47,54]. However, digital agents act independently or are triggered by voice control to provide information or document the conversation, requiring less attention from the physician. The form of digital agents integrated into the conversation can range from shared screens or smart speakers to human-like robots. Indeed, technological advances have brought such user interfaces and digital agents even closer to reality. Further research should indicate what patients and physicians are most likely to accept.

*4. The digital agent should support physicians by taking over administrative duties.*

Administration prevents physicians from doing what they were trained to do (at considerable expense) and reduces their job satisfaction. The time pressure resulting from these administrative duties is a well-known problem that affects patient health outcomes [1,2,12]. This issue surfaced in

the interviews with physicians and patients who were dissatisfied with their treatment. A significant role for digital experts is, therefore, to relieve physicians from as many administrative duties as possible. However, it is essential for physicians that their medical reasoning is viewed as something other than mere administration. Simply recording, transcribing, and summarizing the conversation is necessary, but it is not the whole story. Digital experts must allow for medical reasoning or even ask for it.

## Requirements for Handover from Digital Experts to Digital Companions

To ensure a seamless patient experience, information gathered and discussed during the consultation must be passed from the digital experts supporting the consultation to a patient's digital companion.

*5. The digital agent should tailor information/patient education to individual patient needs and preferences.*

In supporting consultation, digital experts could, for example, provide appropriate information at the appropriate time. Then, after consultation, digital companions could continue patient education between consultations that is tailored to their information needs and preferences. This can give physicians extra time during consultations [1,2] and assist patients in recalling recommendations and information [19,23,24]. In contrast to reading widely circulated brochures, leaflets, and generalized online sources [28,29,31,32,107], patients receive personalized information matching their specific circumstances and treatment plans. This saves time by reducing the need to guide patients away from potentially incorrect self-diagnosis [30].

Our interviews indicated that physicians effectively tailor information to their patients' needs and backgrounds. Therefore, digital agents in the form of digital experts and companions must keep up with or even outperform physicians to add value. To achieve this, digital experts should either be able to draw on predefined patient profiles or interpret and assess patient preferences and backgrounds correctly. Physicians understandably insist on maintaining overall control since they are liable for the information they give their patients. A suboptimal solution would require physicians to verify the information they provide patients via the digital companion. In contrast, a better solution would ensure (in a trusted way) that the information offered was consistent with the physician's directions.

## Requirements for the Digital Companion Between Consultations

Digital companions support patients as digital agents between consultations by integrating and extending the functionality of patient portals, PHRs, and mHealth apps.

*6. The digital agent should offer adaptive interventions for behavioral change.*

In conventional lifestyle change treatment, adaptive interventions are standard, and physicians and patients adapt and agree on treatment every few weeks or months, ideally in a shared decision-making process [3,4,6,7,9]. However, adjustment cycles are bound to consultation cycles, and in the meantime, patients may treat themselves incorrectly or discontinue a treatment owing to a lack of corrective measures. Here, digital agents in the form of digital companions can shorten the cycle considerably. Depending on a patient's mood, context, experience, and feedback, the digital companion can adjust treatment within days, hours, minutes, or even seconds [85,86]. In our interviews, patients welcomed the idea of such functional flexibility. The challenge for the digital agent, however, is to offer adaptive interventions that align with the respective physician's recommendations, comply with medical device regulations, and fulfill safety and performance

requirements. Further research must demonstrate that this type of adaptive intervention will improve treatment adherence.

*7. The digital agent should measure and monitor patient adherence to treatment and provide physicians with easy-to-read/easy-to-interpret summaries.*

Measuring patient adherence to treatment is a prerequisite for adaptive interventions [13]. Our interviews indicate room for improvement regarding measuring treatment adherence – particularly for exercise and lifestyle changes. Digital companions are well suited to measure adherence based on objective data from sensors and subjective data, such as chatbot conversations with patients. The interviewed physicians indicated they would accept patient behavior monitoring if digital companions aggregated monitoring results and communicated them directly to EMRs. The literature also calls for this kind of workflow integration [62,74,77,78]. However, the digital companion must be able to recognize red-flag situations and respond appropriately because the burden of constantly monitoring results cannot rest with physicians.

Further research is needed to determine how patients respond to behavioral monitoring. The interviewed physicians anticipate positive effects, such as patients becoming “experts” on their condition, but also adverse effects, such as patients relinquishing responsibility for their actions. Therefore, digital agents must monitor patients in a supportive way and report the results in a form that assists rather than overloads the physician.

*8. The digital agent should react to feedback and questions from patients between consultations.*

The more sophisticated digital companions’ communication and interaction skills are, the greater the expectation patients have for them to react appropriately. It is insufficient simply to give patients access to information through patient portals or PHRs [62,63] or have chatbots handling patient questions and feedback. In certain circumstances, patients still wish to talk to their human physician. In such cases, a triage mechanism might involve physicians only when necessary. However, the associated liability issues affecting physicians (e.g., in the case of suicidal intent) must be resolved.

## **Requirements for the Integration of Digital Experts and Digital Companions**

Only the integration of digital experts and digital companions can unlock the full potential of these agents to support the entire consultation process for the mutual benefit of patients and physicians.

*9. The digital agent should integrate consultation support (digital experts) and patient apps (digital companions).*

Integrating digital experts and digital companions closes the loop from one consultation to the next and synergistically increases the benefits of both agents [108]. From digital expert to digital companion, personalized information about diagnosis and treatment is transmitted immediately at the end of the consultation. This avoids media discontinuity, overcomes poor recall of recommendations or information, and allows patients to implement correct therapy immediately. Some of this is already part of patient portals or PHRs [62,63]. However, making this information available in an mHealth app supported by digital agents allows for better interactivity, adherence support, and measurement. Since access to information alone has not proven effective [64,65], the mHealth approach promises greater effectiveness. From the digital companion to the digital expert, adherence

measurements are fed back based on sensor data and patient-reported outcome measures (e.g., diary entries and chatbot threads). This allows physicians to prepare for the next consultation and saves time because patients do not have to report verbally what they have already entered into the app. The physicians and patients interviewed welcomed this focus and time-saving measure, while the literature also calls for workflow integration along these lines [77,109–111].

## Limitations

We derived these requirements for the design of digital agents to support consultation, adherence to treatment, and health literacy solely based on the statements made in our in-depth interviews with patients and physicians. For this reason, the nine resulting requirements cannot be described as exhaustive. In particular, many necessary non-functional requirements are still lacking.

Furthermore, this study was conducted in Switzerland, which has one of the most expensive healthcare systems in the world. According to participating doctors, the standard consultation time is 20 minutes, which is significantly longer than in many other countries. The responses from patients and physicians in other places and cultures might differ considerably. Further limitations arise from the nature of a qualitative study based on a purposive sample. While such a study results in a broad picture and deep insights, it may not be representative, even for Switzerland. In addition, it is impossible to quantify the importance of an issue, suggested solutions, participant feedback, or the derived design requirements. For such purposes, surveys built on the insights of this paper are better suited. In addition, we cannot draw any conclusions relating to specific user groups or medical disciplines. The fact that interview partners from very diverse backgrounds made similar observations and judgments indicates that our findings could be applied to various disciplines and user groups.

## Conclusions and Future Work

With generative AI such as ChatGPT, the time for digital agents to support consultation, adherence to treatment, and health literacy may have arrived. Indeed, there is enormous potential for patients and physicians to benefit from this new technology. Through in-depth interviews, both parties revealed their opinions on descriptions of a silent and a communicative digital expert to support consultation and a digital companion to accompany patients between consultations. Their responses are synthesized into the following nine requirements for the design of digital agents to support consultations.

The digital agent should...

1. make its role in the triadic consultation transparent.
2. encourage trust and support the physician-patient relationship while safeguarding physician credibility.
3. help physicians to focus on the patient during the consultation.
4. support physicians by taking over administrative duties.
5. tailor information/patient education to individual patient needs and preferences.
6. offer adaptive interventions for behavioral change.
7. measure and monitor patient adherence to treatment and provide physicians with easy-to-read/easy-to-interpret summaries.
8. react to feedback and questions from patients between consultations.
9. integrate consultation support (digital experts) and patient apps (digital companions).

Some recommendations for future research were also offered in the discussion section. In addition, we suggest the following:

(a) Obtain a complete set of requirements for the design of digital agents for consultation; a full requirement engineering approach would need to be followed and explored in the field. This would include an analysis of the technical feasibility and economic viability [104] of the system, the results serving as a starting point.

(b) Depending on where the digital agents are to be deployed, this study could be replicated with local patients and physicians.

## CRedit Author Statement and Acknowledgements

**Andri Färber:** Conceptualization, Methodology, Validation, Investigation, Data Curation, Writing - Original Draft, Writing - Review & Editing, Visualization, Project administration. **Christiane Schwabe:** Writing - Original Draft, Writing - Review & Editing. **Philipp H. Stalder:** Investigation. **Mateusz Dolata:** Conceptualization, Writing - Review & Editing. **Gerhard Schwabe:** Conceptualization, Writing - Review, Editing, Rewriting some sections, Supervision.

Thank you to Dr Andrea Koppitz, Professor of Nursing, for reviewing the codebook and assisting us with her profound healthcare knowledge. Furthermore, we would like to thank Dominik Spescha and Daniel Degenhardt for their support in conducting, transcribing, and analyzing the interviews.

## Conflicts of Interest

None declared.

## Abbreviations

CSCW: Computer-supported cooperative work

DC: Digital Companion

EMR: Electronic medical records

ePDA: Encounter patient decision aid

PHR: Personal health records

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## Supplementary Files

## CONSORT (or other) checklists

ISSM\_COREQ\_Checklist, as requested by the editor and the reviewers.

URL: <http://asset.jmir.pub/assets/3657cb5a1772ba6d6e095d4b49aa9b29.pdf>