# Enhancing Pediatric Communication: The Role of an AI-Driven Chatbot in Facilitating Child-Parent-Provider Interaction


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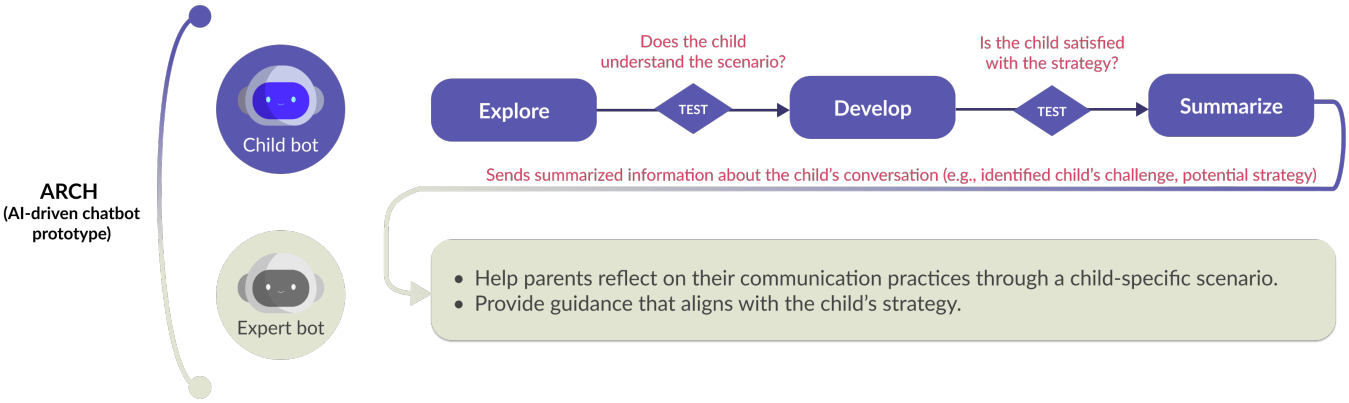


**Figure 1: Conversation flow of ARCH, designed to identify child patients' communication needs and provide relevant guidance. ARCH consists of two chatbot instances: Child Bot, which helps children express concerns, and Expert Bot, which provides anonymized scenarios and guidance for parents. The conversation flows linearly from Child Bot to Expert Bot. Child Bot includes three conversation stages to better guide interactions with child patients, while Expert Bot has one stage for providing guidance to parents.**


## ABSTRACT

Communication with child patients is challenging due to their developing ability to express emotions and symptoms. Additionally, healthcare providers often have limited time to offer resources to parents. By leveraging AI to facilitate free-form conversations, our study aims to design an AI-driven chatbot to bridge these gaps in child-parent-provider communication. We conducted two studies: 1) design sessions with 12 children with cancer and their parents, which informed the development of our chatbot, ARCH, and 2) an interview study with 15 pediatric care experts to identify potential challenges and refine ARCH's role in pediatric communication. Our findings highlight three key roles for ARCH: providing an expressive outlet for children, offering reassurance to parents, and serving as an assessment tool for providers. We conclude by discussing design considerations for AI-driven chatbots in pediatric communication, such as creating communication spaces, balancing the expectations of children and parents, and addressing potential cultural differences.



## CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in HCI**; *Natural language interfaces.*

## KEYWORDS

Chatbots, Child Patients, Parents, Healthcare, Communication

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# 1 INTRODUCTION

In pediatric cancer care, effective communication with children is critical for better health outcomes in illness management, positively impacting their emotional well-being, psychological effects [3] and coping skills for illness and treatment [13]. However, communication with child patients is challenging since it involves more sensitivity and complexity than that with adults [18, 40]. Unlike adult patients, whose decisions are highly based on medical knowledge and skills, child patients' decisions are significantly influenced by their emotions [63]. Thus, addressing child patients' communication needs beyond health literacy is essential.

Despite the importance of addressing child patients' communication needs, pediatric communication often focuses on parents' needs and concerns, potentially overlooking those of the children themselves [8, 33, 57]. Parents may struggle to understand their child's perception of illness, choose appropriate communication methods, and recognize their child's emotional state [49]. This challenge exists because children's needs are often implicit and dynamically shifting, becoming apparent only in specific situations. While healthcare providers have specialized training and strategies for communicating with child patients and can guide parents effectively [50], their availability is limited to consultation periods.

In the HCI community, previous studies have provided design implications to support health communication with child patients. Examples include a drawing tool that allows children to illustrate their headaches [25] and a tablet-based tool with animations and options that children can choose to describe their symptoms [4]. Yet, these interventions focus primarily on providing communication aids to children with a diagnosis so that they can receive or provide relevant medical information. They lack the ability to identify the communication needs of child patients and offer guidance to share these needs with parents and healthcare providers.

To better meet the complex needs of children in pediatric communication, we saw opportunities for an AI-driven chatbot as a facilitator, given its capability to understand and respond to intricate user input. AI-driven chatbots have been widely used in healthcare settings, such as helping psychiatric patients write diary entries [29] and encouraging children to share their experiences and express related emotions [51]. Emerging AI techniques have enabled these chatbots to engage in more natural free-form conversations with users. These conversations are particularly useful for steering conversations with children [51] or helping children develop question-asking skills [2]. Despite the potential benefits, there is a lack of insight in designing chatbots to improve pediatric communication. More research is needed to explore how AI-driven chatbots should be designed and integrated into pediatric communication involving child patients, parents, and healthcare providers. Inspired by this potential of AI-driven chatbots in pediatric communication, we aimed to answer the following research questions:

(1) How should we design AI-driven chatbots to address the communication needs of children with cancer?

(2) What are the expected roles and potential challenges of such chatbots in supporting communication between children, parents, and healthcare providers?

To answer these questions, we present an empirical process for prototyping an AI-driven chatbot in pediatric communication, involving child patients, parents, and healthcare providers to identify the needs and expectations of the chatbot. We first conducted individual design sessions with 12 pairs of children with cancer and their parents to gain design insights for an AI-driven chatbot that supports child patients' communication. The findings of these design sessions informed the development of a chatbot prototype, ARCH (Agents for Reinforcing Child-parent Health communication; Figure 1), that consists of two components: Child Bot that helps children express their concerns and Expert Bot that provides anonymized scenarios and guidance to parents. To further refine the prototype, we conducted interviews with experts in pediatric care –including pediatric psychologists, clinical social workers, and therapists– to gather perspectives on ARCH, as its role as a communication facilitator aligns with their core responsibilities.

We recruited experts with diverse professional backgrounds from both the United States and Korea. To address challenges in recruiting specialized healthcare providers in the United States, we adopted a multi-site approach and included participants from Korea. Both regions share similar pediatric healthcare principles and a common understanding of the critical importance of pediatric communication (e.g., assessing communication based on children's developmental stages [36]), which informed our comprehensive recruitment strategy.

During expert interviews, we asked participants to walk through ARCH and share their expectations and potential challenges for an AI-driven chatbot in pediatric communication. Our findings highlight three key roles for ARCH: providing an expressive outlet for children, offering reassurance to parents, and serving as an assessment tool for healthcare providers. Based on these findings, we discuss the potential of AI-driven chatbots in pediatric care and key design considerations for effective communication between child patients, parents, and healthcare providers. Hence, this work offers two main contributions: (1) an empirical understanding of how an AI-driven chatbot should be designed and placed in pediatric communication, and (2) design considerations for AI-driven chatbots to enhance communication among child patients, parents, and healthcare providers.

# 2 RELATED WORK

In this section, we explore prior studies on health communication in pediatric cancer care and examine existing technology that supports child-parent interactions. We then review previous work on the use of chatbots in healthcare contexts, presenting potential opportunities for chatbots to enhance child-parent communication in pediatric care.

## 2.1 Health Communication in Pediatric Care

Communicating with child patients presents unique challenges compared to adult patients. In addition to children's developing communication skills, emotional and psychological factors can hinder effective communication between children and their parents. Prior studies indicate that parents, who typically serve as the primary gatekeepers of health information, may struggle with information sharing. These challenges include parental depressive

symptoms [26, 46] and posttraumatic stress [39], as well as instances when parents' anticipation of their child's emotional response affects their disclosure decisions [13]. These behaviors impact what they share or hide from their children and how they describe the illness and treatment. There are even more barriers in the pediatric cancer context, which is often sensitive for both children and parents. A prior study identified that a significant obstacle to parent-child communication in the childhood cancer context is the desire of both parents and children to protect each other from the pain associated with discussions of treatment and its risks [53]. Similarly, Seo *et al.* [49] identified three communication challenges between child patients and parents: discrepancies in perceptions of being a patient, different preferences in communication methods, and uncommunicated children's emotions. A common theme among these challenges was that parents could not fully identify the implicit needs of their children.

The role of parents in health communication in pediatric care is significant. How and what information parents share with their child, i.e., the parent's communication style, is critical to identifying the child's needs and providing the necessary support accordingly. In particular, certain communication styles can have a negative impact and cause distress for the child. Cline *et al.* [14] identified four distinct communication patterns used by parental caregivers when communicating with their child during clinic visits: normalizing, supporting, distancing, and invalidating. Among these, invalidation (e.g., lying about what has occurred or is about to occur, responding with anger or irritation) caused significantly more distress for the children than any other communication pattern. On the other hand, offering full information about the illness helped the children be better prepared for coping with their diagnosis [13, 14].

Due to the importance of their roles, parents need proper guidance on communication with their children in pediatric care. As described in previous work (e.g., [49]), parents often seek relevant support from healthcare providers. However, those experts are not easily accessible for offering resources and exploring the issues due to their limited availability. Thus, even when parents identify potential issues in communication with their children, they still need more guidance. On the other hand, providers can facilitate child-parent communication but are limited to consultations at the clinic to investigate and address potential issues.

## 2.2 Technology to Support Child-Parent Interactions in Pediatric Care

Prior studies in the HCI literature have extensively explored child-parent interactions in various contexts of chronic illness care, such as cancer [23, 24, 49], diabetes [10, 11, 58], autism [35, 61], and asthma [43]. These studies have demonstrated how technology can facilitate child-parent collaboration in health management. For instance, health monitoring technology enables parents to track a child's glucose levels remotely [58], while systems have been designed to support teens working with parents for long-term treatment adherence [24]. Similarly, collaborative child development tracking systems allow parents to assess their child's developmental progress [54]. These interventions underscore the potential for technology to improve collaborative health management between parents and children. Educational games have also been designed to increase patients' knowledge about their illness management [12, 32] and promote collaborative activities between child patients, caregivers, and child life specialists through interactive stories [6].

Several studies have particularly introduced tools aimed at improving communication between caregivers (e.g., parents, clinicians) and child patients during clinical visits. Examples include a tangible conversation tool that encourages children's active participation in consultations by selecting tokens representing topics of interest [5], and an illustration tool that aids children in describing their symptoms to clinicians [25]. Specifically for pediatric cancer care, Arvidsson *et al.* redesigned a computer-based communication tool for child patients into a tablet app [4]. The redesigned app utilizes animations and sound to engage children more effectively with the tool and assist them in answering questions about their symptoms or any health-related problems.

Although these technological interventions facilitate the monitoring of children's health information and offer child-friendly tools to support communication with child patients, they often fail to address the communication challenges that arise from differing viewpoints, preferences, and expectations between parents and children when discussing health-related matters. Given that illness affects not only a child's physical well-being but also their emotional, social, and psychological states, there is a pressing need for technology that enhances parent-child communication in the context of daily illness management.

## 2.3 Chatbots in Pediatric Healthcare

In managing pediatric healthcare, chatbots have shown promising opportunities in caring for the well-being of children and adolescents, including addressing emotional needs [48, 59], mental health [16, 22], reproductive health problems [44], and sleep behaviors [1]. Through conversational interactions, chatbots offer a space where children can freely share their stories and express their emotions in their own words while keeping their secrets from others [28]. Recognizing the advantages of conversational interactions, previous research has proposed chatbots as a promising tool to support children's emotion regulation and promote their mental health. Dosovitsky *et al.* [16] introduced BethBot, a chatbot incorporating cognitive behavioral therapy (CBT) modules designed to provide psychoeducation for adolescents, focusing on depression and coping skills. Through analysis of user experience feedback, Dosovitsky *et al.* found that adolescents viewed BethBot as an acceptable mental health resource that could potentially alleviate their symptoms. Similarly, Santos *et al.* [48] developed a chatbot utilizing an adapted storytelling strategy. The chatbot identifies emotions by recognizing specific keywords from children's responses. User testing with children aged 9-11 demonstrated that participants felt comfortable sharing their stories with the chatbot, which accurately detected their emotions based on the storytelling approach.

While previous research has highlighted the benefits of using chatbots for children, most chatbot studies predominantly focus on tracking child patients physical or mental health (e.g., sleep patterns and emotions) or providing medical guidance or resources (e.g., mental health interventions). Further studies are needed to investigate how chatbots can facilitate health communication, especially pediatric communication. In particular, there is emerging

interest in AI-driven chatbots in healthcare, such as helping psychiatric patients to write diary entries [29] and encouraging children to share their experiences and express related emotions [51]. Also, a recent study demonstrated how an AI-driven agent can assist children in generating curious questions, offering potential for developing their question-asking skills [2]. In a similar vein, AI-driven chatbots could help children develop skills to express their symptoms, emotions, and preferences in their communication with parents and healthcare providers. Free-form conversations may help facilitate the different needs of each stakeholder in pediatric communication. Inspired by this potential, we investigate how an AI-driven chatbot can be designed and positioned in communication between child patients, parents, and healthcare providers.

## 3 DESIGN SESSIONS WITH CHILD-PARENT PAIRS

We began by conducting design sessions with child patients and their parents. Given the varying health conditions of the child participants, we held individual sessions with each child-parent pair. The goal of these sessions was to understand the expectations of both child patients and their parents for an AI-driven chatbot designed to support children in communicating health-related information.

### 3.1 Methods

*3.1.1 Participants.* Potential participants were considered eligible for the study if the child patients were between 6 and 12 years of age and had been diagnosed with cancer for at least two months. These requirements enabled us to engage with children who had already begun the treatment process and needed significant external care either at the hospital or at home due to their young age. We recruited 12 eligible child-parent pairs for concurrent interviews. The child patients ranged in age from 9 to 12, with an equal number of boys and girls (See Table 1). Hereinafter, we label child patients with "C" and their parents with "P." We recruited our study participants using flyers at the clinic or from the research team in the clinic. One of the co-authors, a pediatric physician, made initial contact with the parents, and then a researcher introduced our study for recruitment. As a pair, the children and parents were compensated with a $20 gift card for participation. We followed our university's IRB requirements for obtaining child assent and parent consent for interviews; we obtained verbal assent from the child patients, whereas their parents provided written consent on behalf of their children and for their participation. The informed consent processes are standard for research in pediatric settings in the United States.

**Table 1: Demographic information of the participants in the design sessions.**

| Participant | Age | Gender | Diagnosis | Setting |
|---|---|---|---|---|
| **C1** | 11 | Boy | Pancreatic cancer | Remote |
| **C2** | 11 | Girl | Leukemia | In-person |
| **C3** | 11 | Boy | Brain tumor | Remote |
| **C4** | 11 | Girl | Leukemia | Remote |
| **C5** | 11 | Boy | Leukemia | In-person |
| **C6** | 12 | Girl | Leukemia | In-person |
| **C7** | 11 | Boy | Brain tumor | Remote |
| **C8** | 11 | Girl | Brain tumor | Remote |
| **C9** | 9 | Girl | Leukemia | Remote |
| **C10** | 10 | Boy | Sarcoma | In-person |
| **C11** | 11 | Boy | Brain tumor | Remote |
| **C12** | 11 | Girl | Sarcoma | Remote |

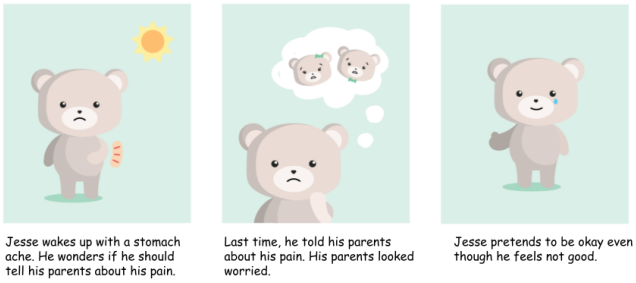



**Figure 2: A sample scenario used for design sessions with child patients. This scenario describes a situation when a cancer patient, Jesse, did not share his pain with his parents because he did not want them to worry about him.**

*3.1.2 Procedures.* The design sessions were conducted remotely via videoconferencing or in person in a private conference room, depending on the participants' preferences and health conditions. Each session lasted about 60 minutes. These sessions aimed to understand how child patients manage communication issues with their parents and develop design ideas for a chatbot to support child-parent communication in pediatric care settings. Each session had three parts: 1) scenario-based interview (child only), 2) design activity (child only), and 3) pair discussion (child and parent). Parents were present throughout the session only when requested by the children. In those cases, parents' interventions were limited to helping children understand questions or reminding them of past experiences so that children would feel more comfortable sharing their opinions. Otherwise, in most remote sessions, parents did not sit directly next to their children but stayed in the same space for safety reasons. Some parents, with their children's permission, chose to stay in a different location, such as another room in their home. To make the sessions more engaging for the children, we provided drawing materials or asked remote participants to prepare their own supplies in advance. All sessions were recorded with the consent of the participants.

The scenario-based interviews aimed to identify how child patients perceive and manage communication issues with their parents. Since direct questions about their challenges could induce anxiety in some child participants, we decided to use scenarios as a probe. Inspired by the comic-boarding approach for co-designing with children [37], we created comic strips to describe various communication challenges that child patients and parents may experience. We used these scenarios as prompts to explore how each pair navigates specific contexts and mitigates communication challenges. One sample scenario was about a child not sharing their stomachache with their parents, fearing the parents would become worried (See Figure 2). These scenarios were created based on the findings of previous studies (e.g., [49, 53]).

Each session was conducted by at least two members of our research team: a moderator who guided the discussion and activities, and a note-taker. For each scenario, the moderator helped the child patients understand the context by asking them to describe it back to the researchers and their parents. The moderator then asked follow-up questions about how the participants would resolve the issues if they were in such a situation, if they had experienced similar situations, and what they did in those situations.

Next, in the design activity, the note-taker was particularly attentive to nonverbal responses from the children that could not be captured on audio (e.g., nodding as "yes"). The moderator invited child participants to act as designers working alongside researchers to create support tools for peer patients. This role assignment was intended to make child participants understand that their designs would not be judged or evaluated. Instead, it aimed to give them more control over the design activity, making them feel comfortable sharing their ideas.

Children were then asked to draw a fictional character, a Buddy, who could provide guidance to address the issues described in the scenarios. This approach was inspired by the work of Aarts *et al.* on designing a chatbot for children's sleep behavior [1]. Child participants shared their ideas about who their Buddy would be and how it could help them or other children with these communication problems. They were then asked to describe what kind of conversations they or other children with cancer would have with Buddy. Through this activity, researchers could explore children's expectations for support when facing issues with their parents. While the children were drawing, the researchers asked the parents about their communication practices related to health information and followed up on their children's responses to the scenarios.

Lastly, each child participant introduced their character to their parents during the pair discussion. The research team then explained that the characters represent chatbots designed to support child-parent communication and asked both parties how such chatbots could assist them in addressing potential communication issues. During these discussions, when parents asked questions about their children's designs (e.g., how the chatbot would share information with parents), we redirected the questions to the children, as they were the designers. This approach prevented parent-dominant discussions and ensured balanced participation from both children and parents to consider both perspectives.

*3.1.3 Data Analysis.* We primarily analyzed the transcripts and observational notes from the design sessions. The first author coded the transcripts to identify emerging themes, such as Buddy's expected roles and the information that children and parents wanted to learn from Buddy. Children's drawings were used as supplementary data to better understand their descriptions of Buddy. The research team then engaged in several discussions to rearrange and merge these themes into key design considerations for an AI-driven chatbot to support pediatric communication. All of the collected data (e.g., audio recordings, transcripts) were stored on password-protected servers accessible only to authorized researchers.

*3.1.4 Ethical Considerations.* We carefully implemented ethical protocols for child participants in our user study. First, we followed our university's IRB requirements to obtain separate consent from both the children and their parents: verbal assent from child patients and written consent from parents. Before each session, we reconfirmed the willingness of the children to participate. Second, parents reviewed all scenarios before their children were interviewed to prevent potential triggers (e.g., trauma-related experiences). We prepared a backup interview protocol featuring a speculative scenario describing how a chatbot could support child-parent communication, although no participants needed this during the study. Third, we prioritized protecting children's privacy when they shared sensitive information. However, our safety guidelines specified that we would notify healthcare providers if the information were to suggest a potential risk to children's well-being or safety (e.g., unaddressed emotional distress or traumatic experiences related to illness). During the design sessions, no such incidents occurred. Nevertheless, we remained attentive to the children's health conditions and reminded them of their right to withdraw from the study at any time if they felt uncomfortable.

## 3.2 Findings from Design Sessions

From our design sessions with child-parent pairs, we identified three design considerations for a chatbot that would support child-parent communication in the context of pediatric cancer care. Each consideration represents lessons learned from the design sessions.

**First, a chatbot should promote a peer relationship with children.** Most of the child participants described their Buddy as a peer patient who listens to their stories and makes them feel comfortable sharing their feelings. Specifically, some children expected Buddy to be a companion experiencing similar challenges and illness management. In such a relationship with Buddy, the children are encouraged to solve potential communication issues together. For example, P11 wanted to introduce his Buddy to other children with cancer who might have difficulty communicating with their parents. The Buddy would then support these children by suggesting that they talk to their parents about the issue together. Since both the children and the Buddy share similar feelings, engaging in this process together could provide mutual encouragement and motivation: *"Candle [C11's Buddy] is saying: 'I know how you feel. Maybe we should both go through this together and tell both of our parents at the same time.' … Because, like both of them are feeling the same way, but they don't feel like they can tell their parents, so both of them will get the motivation to the other one and the, and you will get most of it motivation back." (C11, age 11).* This quote outlines the child participants' expectations for developing peer support with a chatbot to manage potential communication issues, rather than using a chatbot that merely provides instructions. We gained insight into the type of relationship that the child participants wish to establish with a chatbot.

**Second, a chatbot should consider parents' dilemma between keeping a child's privacy and obtaining information about the child.** During the design sessions, many child participants perceived their Buddy as a friend with whom they could safely share their feelings or secrets. On the other hand, parents wanted Buddy to tell them critical information about their child (e.g., feeling unwell after treatment). Most of the parent participants mentioned this dilemma. For instance, P7 wants the Buddy to convey everything about the child's feelings but also wants to maintain the Buddy as a safe space for the child: *"I would want it [the Buddy]*

*to tell me how they [child users] are feeling [to their parents] … And then the flip side. I do feel that they [children] need a spot where the child wants it to be confidential. A lot of kids do need that safe space. … It's a tough question." (P7).* To resolve this dilemma, some parents suggested that Buddy directly ask the children for consent to share information. However, if children do not agree, it becomes complicated to share critical information with the parents. Thus, P9 introduced the "Buddy's parents." She described how Buddy could have its own parents, who could then share the child's needs with the child's parents: *"I don't know if I would expect a friend to tell the [child's] parent that he [the child] is not feeling good, but I would think [the friend] would tell his parents."* This approach suggests creating a chatbot with a parental or adult figure that interacts with parents individually to deliver important information about their children, supporting child-parent communication. This concept highlighted a potential opportunity for separate interactions with both children and parents, enabling the protection of children's privacy while still providing necessary information to the parents.

**Third, a chatbot should encourage open communication between children and parents.** Interestingly, many children and parents shared similar suggestions for a chatbot to provide relevant guidance. Both child and parent participants expected the chatbot to explain why asking questions or sharing emotions with parents is important and to encourage more open communication. For instance, C6 described how his Buddy would encourage children to ask their parents for answers: *"[If a child] has questions but he hasn't asked yet. Maybe [the Buddy] would tell [the child] 'you should ask your parents because they might know the answer to it.'" (C6, age 12).* Moreover, P10 wanted a chatbot to be more "teachable" by asking children how they would solve communication problems with their parents. Similarly, P1 expected a chatbot to teach children that adults can manage their own feelings (e.g., worries) so that children can share their feelings or pain: *"It would be great if his buddy [C1's fictional character] could teach him that adults can handle big emotions and that he doesn't always have to worry about us.… So, it'd be really nice if Buddy could show him that. He [C1] doesn't have to protect everyone around him. He can be real and say like, I'm sad, or I'm scared."* As shown in these examples, both child and parent participants expected a chatbot to encourage or teach children to share their feelings and ask questions in order to communicate more openly with their parents.

# 4 ARCH: PROTOTYPE DEVELOPMENT

## 4.1 Prototype Design

Drawing on the findings of the design sessions, we designed a chatbot prototype ARCH (Agents for Reinforcing Child-parent Health communication), consisting of two chatbot instances: the Child Bot and the Expert Bot. This decision to have two chatbot instances was made to better meet the different needs of child patients and parents while facilitating communication between them. The Child Bot is a chatbot with a peer persona with which child users can easily interact. It is designed to steer conversations with children based on three stages: Explore, Develop, and Summarize (See Figure 1).

In Explore, the Child Bot introduces itself as a peer with cancer and builds rapport with child users by asking and sharing their interests or hobbies. It then shares concerns about communicating with its parents (e.g., not telling its parents about stomach aches to avoid causing them worry) and asks users if they understand the issue. Once users understand the context, the Child Bot moves to the next conversation stage.

In Develop stage, the Child Bot asks users if they had similar experiences and what happened to them. If users do not have similar experiences, the Child Bot asks users what they would do if they were in the same situation. When users share their experiences or expectations, the Child Bot empathizes with the user's experiences and helps them develop potential solutions to address the issues. If the user is unsure about solutions, the Child Bot suggests some solutions (e.g., telling siblings or other family members about pains first rather than parents). If the user expresses their determination to try the suggested solution, the Child Bot moves to the final stage.

In Summarize stage, the Child Bot generates a story of the user's experience and asks them if their story can be shared with others after anonymizing their names. This approach indicates a consent process for sharing the user's needs and information. If the child user declines, the story initially used to share with the child user will be delivered to the Expert Bot instead of the new story formulated by the child user's actual experience.

The Expert Bot is designed to provide communication guidance and resources for parents. The name "Expert Bot" implies its expertise in communication with child patients. The Expert Bot would be introduced as part of an educational program for parents to improve their communication with child patients. Unlike the Child Bot, which requires more careful conversation steering, the Expert Bot has a single conversation stage. Once the child user's information is received from the Child Bot, the Expert Bot generates a new scenario with anonymous names that still represent the child user's communication needs. For example, if a child does not share his headache with his parents to avoid worrying them, the Expert Bot changes the name and type of pain (e.g., stomach ache) while maintaining the key concern (e.g., not making parents worried). After presenting the scenario to parents, the Expert Bot asks parents how they would respond to the child's behaviors if they were in that situation (See Figure 3 for a sample conversation). Then, the Expert Bot offers guidance on parents' communication practices and relevant resources for contacting nearby experts.

Recognizing the limited participation of child patients in communication with parents or providers [42, 56], we designed ARCH to initially focus on guiding child patients with a supplementary component for parents. Although the Expert Bot is designed to meet parents' needs for critical information about their children (e.g., how they feel), the Child Bot is the core component. Thus, the conversation flow of ARCH is linear, beginning with the Child Bot and leading to the Expert Bot. A key aspect of this flow is where the Child Bot provides information to the Expert Bot (See Figure 1). We envisioned this approach would help identify communication issues from the perspectives of children and offer guidance to parents to mitigate the challenges.

## 4.2 Prototype Implementation

ARCH is a complex system with multiple conversation stages, which incorporates two chatbot instances. We used open-source code that provides a freeform chat interface, initially designed to support

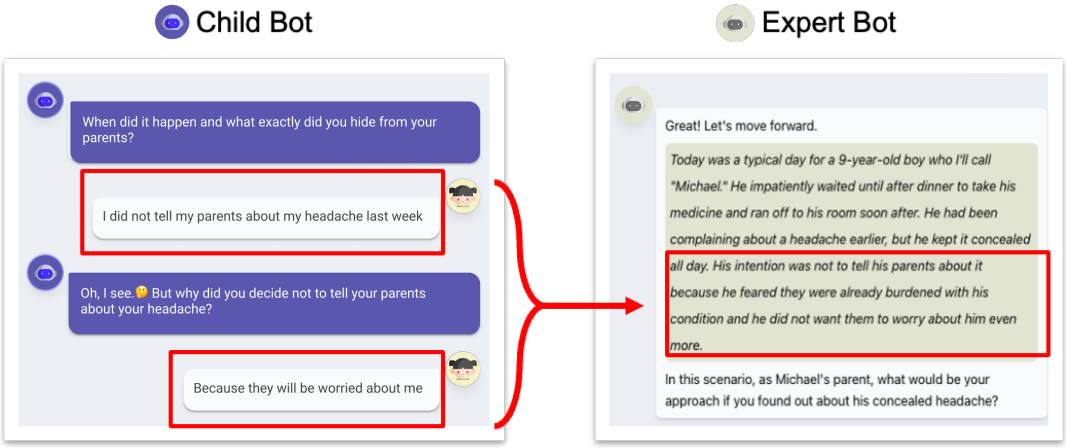



**Figure 3: A sample conversation between the Child Bot and a user. The information from the Child Bot's conversation is delivered to the Expert Bot as a communication scenario. The Expert Bot then asks parents what they would do in this scenario. Depending on parents' responses, the Expert Bot provides guidance that aligns with children's needs.**

children's emotional sharing and expression [51]. We built on this source code to implement each chatbot instance of ARCH because ARCH operates on state machines that control the chatbot's behavior by dynamically mapping conversational phases based on predefined rules, as described in Section 4.1. The chatbot moves from one state to another when a user submits messages that trigger state changes. The Child Bot is designed as a state machine with three phases with different goals and conditions, while the Expert Bot has a single state. For instance, the Child Bot begins a conversation in the Explore phase, during which it shares a concern with the child user. Once the user understands the issue, a transition is triggered and the chatbot switches to the next phase.

We then integrated Child Bot and Expert Bot into a unified web application, implemented using ReactJS with a FastAPI back-end. Users are prompted to input the child's name and age. The input data are sent to the back-end for authentication and chat session initialization, leading them to the corresponding chat interface. Before starting a session, the Expert Bot receives the child's name and age as identification to retrieve the information collected by the Child Bot. The Expert Bot then uses the information to generate a scenario for parents. If child users do not share their experiences (i.e., no information for scenario generation), the Expert Bot presents the same scenario about the Child Bot's concerns that are shared with the child users.

Our system employs large language models (LLMs). LLMs allowed ARCH to engage in free-form conversations with users and play the role of either a peer or an expert, depending on who the user is. After evaluating response quality and efficiency, we chose OpenAI's Chat Completions API with the *gpt-3.5-turbo-16k* model for response generation.

We developed distinct instruction prompts for each chatbot, incorporating few-shot learning examples specifically for the Child Bot. Both chatbots follow general conversation rules (e.g., turn-taking, managing the number of topics, and controlling emoji use) that guide their responses throughout interactions. These rules help shape persona-specific messages by enabling different conversational styles. For the Child Bot, we implemented a strict rule requiring it to respond like a peer (e.g., a 10-year-old) to avoid giving potentially sensitive answers to child users.

Second, the instructions include a phase-specific component that is dynamically generated based on the conversation's status. Each conversational phase is supported by its own conversation analyzer, which collects information and checks whether conditions are met for a transition. For example, the condition for switching from the Explore phase to the next phase requires the child user to demonstrate an understanding of the concern shared by the Child Bot. Additionally, the user must explain why they behaved a certain way in a situation related to the chatbot's concern. If the user does not provide this explanation, the Child Bot will prompt them again, ensuring that all necessary information is gathered before moving to the Develop phase. Similarly, the chatbot continues the conversation in a way that meets the condition for phase transition.

## 5 EXPERT INTERVIEWS WITH ARCH

This section describes our interviews with pediatric communication experts using ARCH. The goal of these interviews was to explore the expected role and value of ARCH and identify potential challenges of its use in pediatric communication. Since ARCH's role as a communication facilitator aligns closely with many experts' core responsibilities—such as supporting the emotional well-being of child patients during illness management—we sought to understand their perspectives and uncover the design rationale, particularly regarding ARCH's positioning in pediatric communication. We also gathered their feedback to refine ARCH's design features.

### 5.1 Methods

*5.1.1 Participants.* We recruited 15 experts in communication with pediatric patients (aged 6-12) with chronic illnesses, such as cancer (Table 2). They were recruited from a university hospital in the United States (Hospital M) and two university hospitals (Hospital Y

& S) in Korea. Our multi-site recruitment in the United States and Korea was grounded in recognizing that pediatric healthcare communication shares fundamental principles across different healthcare systems (e.g., assessing communication based on children's developmental stages [36]). This shared foundation is evident in the adoption of similar textbooks and training materials for pediatric communication in both regions (e.g., [17, 27, 36]). In particular, Korean pediatric psychiatrists who participated in our study mentioned that they frequently learn from case studies and practices derived from U.S. textbooks. By including participants from both regions, we aimed to meet our recruitment goal while capturing a more comprehensive understanding of expert perspectives.

We recruited participants via emails and word-of-mouth. The 15 participants had various occupations, including psychologists, therapists, and clinical social workers. We focused on communication experts who primarily provide guidance on child patients' daily practices, including their social and emotional well-being, and often facilitate child-parent communication. For this study, we prioritized recruiting these experts over clinicians (i.e., physicians and nurses) who tend to focus more on clinical information and procedures. Clinicians usually make referrals to these experts for issues related to communication or emotional well-being. The expert interviews were conducted in a private room (e.g., a medical consultation room or other private room within the hospital), and each interview lasted about 60 minutes. The aim was to identify their perspectives and expectations for our prototype, ARCH, to enhance communication with child patients in pediatric care contexts.

*5.1.2 Procedures.* The expert interviews involved an introduction, prototype review, and debriefing. In introduction, we demonstrated to participants how the system consists of Child Bot and Expert Bot and their linear conversation flow as shown in Fig Figure 1. Then, each participant was assigned a child persona (e.g., a 10-year-old with leukemia) to interact with Child Bot. During these interactions, participants freely chatted while thinking aloud about their impressions of Child Bot's responses. After 10-15 minutes, participants switched to interacting with Expert Bot as the parent of their assigned child persona. Lastly, in the debrief, we asked follow-up questions about how ARCH could enhance child-parent communication and how it would support or hinder their practices.

The interview questions were originally written in English and translated to Korean by the first author. The translation was reviewed by the second and last authors, who are fluent in both languages and familiar with healthcare contexts and study goals. While our protocol wasn't specifically designed to examine cultural differences, some Korean participants voluntarily shared their perspectives on these differences.

*5.1.3 Data Analysis.* We analyzed debriefing transcripts and supplementary notes to identify experts' perspectives and expectations on ARCH. Two researchers independently coded the first three transcripts and resolved discrepancies through multiple rounds of discussion to develop an initial codebook. The remaining transcripts were coded using this codebook, with new codes added as necessary. The Korean transcripts were coded in English, and the translated content was cross-checked against the original transcripts. We then used thematic analysis [7] to identify emerging themes in the collected codes. Through group discussions, we compared, discussed, and revised the recurring themes until agreements were reached. We identified three salient themes based on how ARCH can support each stakeholder (i.e., child patients, parents, and providers) in pediatric communication. We then identified emerging patterns within the themes representing three different roles that ARCH can serve for each stakeholder.

**Table 2: Demographic information of the participants in the expert interviews. *AIAS* refers to the AI Attitude Scale; the scale's total score ranged from 4 to 40 (1 to 10 per item). The higher score indicates the participant has a more positive and open attitude towards AI. These scores were collected to estimate each participant's attitudes toward AI so that we could identify potential biases. *P2 has nine years of experience in caring for children but has four weeks of experience with child patients.**P9 is a dedicated nurse who works in a pediatric cancer care team. Her responsibilities are similar to those of clinical social workers, rather than clinic nurses who help with treatment processes.**

| Participant | Gender | Occupation | Years in Practice | Organization | Location | AIAS(total 40) |
|---|---|---|---|---|---|---|
| **E1** | Female | Clinical social worker | 4 years | Hospital M | US | 34 |
| **E2** | Female | Clinical social worker | 4 weeks* | Hospital M | US | 29 |
| **E3** | Female | Pediatric psychologist | 9 years | Hospital M | US | 29 |
| **E4** | Female | Pediatric psychologist | 9 years | Hospital M | US | 18 |
| **E5** | Female | Pediatric psychologist | 26 years | Hospital M | US | 21 |
| **E6** | Female | Pediatric psychologist | 20 years | Hospital Y | KR | 34 |
| **E7** | Female | Pediatric psychologist | 9 years | Hospital S | KR | 30 |
| **E8** | Female | Art therapist | 9 years | Hospital Y | KR | 20 |
| **E9** | Female | Clinical social worker | 4 years | Hospital Y | KR | 35 |
| **E10** | Female | Play therapist | 6 years | Hospital Y | KR | 34 |
| **E11** | Female | Pediatric nurse** | 7 years | Hospital Y | KR | 24 |
| **E12** | Female | Art therapist | 9 years | Hospital Y | KR | 33 |
| **E13** | Female | Clinical social worker | 3 years | Hospital S | KR | 31 |
| **E14** | Female | Clinical social worker | 3 years | Hospital S | KR | 18 |
| **E15** | Female | Play therapist | 16 years | Hospital S | KR | 25 |

## 5.2 Findings from Expert Interviews

Based on the analysis of expert interviews, we found how ARCH can promote effective communication with child patients. In particular, we identified three roles that a chatbot may take in pediatric communication: emotional outlet for child patients, reflection and verification for parents, and assessment for healthcare providers. These roles represent the experts' concerns and expectations for ARCH to better support child-parent communication in pediatric care. The findings about distinctive roles for different stakeholders further extend the original design rationale of ARCH, which focused on supporting children with communication.

*5.2.1 Emotional Outlet for Child Patients.* A chatbot should serve as an emotional outlet for children, offering empathy and understanding rather than focusing on providing solutions. Most of our expert participants emphasized the importance of supporting children's emotional needs when communicating health-related information with parents. The experts noted that children often struggle to communicate with their parents because their emotions are intertwined with their communication needs. For instance, during intense medical treatments, children are usually isolated from their social circles, mostly spending time with their parents. While relying on their parents, children often project their negative emotions onto or blame their situations on their parents. E10 described an example of a child feeling guilty for bursting out their negative emotions towards their parents: *"A child experiences emotional ups and downs, making the mother's help essential. … On the other hand, the child also tends to blame the mother for many things. Because the child's peer relationships are quite limited, they seem to project many of their feelings onto the mother. As a result, the child feels guilty and expresses a lot of difficulties related to these [communication] issues." (E10).* Similarly, many experts in our study shared observations on how children's emotions influence their communication practices with their parents. Thus, it is important for children to detach their emotions from how they communicate with their parents and what they want to communicate. Many experts emphasized that it requires a lot of time and practice to develop such skills with relevant support from parents. However, Korean children do not usually communicate about their emotions or health-related topics, since even their parents are not comfortable with discussing those topics: *"Especially in Korea, kids aren't as communicative as those in other countries, and even parents often feel uncomfortable with these discussions [health-related conversations]." (E6).* Hence, some of the experts from Korea envisioned ARCH would be an expressive outlet for child patients, with which they may feel comfortable as it would not judge their emotions or experiences.

Furthermore, the current Child Bot is designed to help children explore solutions to their potential communication issues with their parents. Yet, some experts pointed out that it should not force children to find solutions. E8 mentioned that some children might not even notice their "problems": *"Because the child might not actually want to solve the issue. While we offer this tool with the intention of helping them address a problem, the child – especially since they're not an adult – might not even recognize what they're dealing with as a problem. … They might not see their actions as problematic."* Along with E8, a few experts mentioned that the current solution-oriented approach of Child Bot may not work well with child patients as they could not relate to finding solutions when they do not even perceive problems. In addition, some experts highlighted that it is crucial to help children develop their decision-making skills rather than simply following instructions. For instance, E10 described the importance of enabling children to take an active role: *"If they only follow provided solutions without engaging in their own problem-solving process, they might miss out on developing their own coping skills and self-reflection. Offering alternatives and guiding them through different options while encouraging them to find what works best for them helps them grow and learn to manage their own challenges." (E10).* E10 added that helping child patients understand their capabilities builds resilience and self-efficacy.

Considering the importance of addressing children's emotional needs, most of the experts considered Child Bot with a peer persona to be an accessible, safe space for children to share their emotions freely. E1 explicitly noted that children would feel more comfortable talking to Child Bot than their parents or providers since it is *"unbiased, nonjudgmental, and accessible."* Other experts also valued the accessibility of the chatbot since Child Bot may provide timely support to children, unlike parents who may not always be available when needed: *"Parents aren't always available for me to talk to. If my mom is busy preparing a meal or working, I can't really talk to her. But a chatbot is accessible 24/7, so I can talk whenever I want without worrying about timing. That's important because kids' emotions fluctuate throughout the day. There are moments when they really want to talk, and having a chatbot that's always there to listen at just the right time is a big advantage." (E6).* E6 noted that the timing of addressing children's emotional needs is critical, as they often experience emotional fluctuations throughout the day. Children can use ARCH whenever they need to express their emotions.

However, some experts expressed their concerns about using the chatbot as an accessible outlet for children. Specifically, some stated that easy access would result in children's over-reliance on the chatbot, hindering children's communication with parents. Thus, it is important for the chatbot to keep its distance from children to minimize negative impacts on their communication practices with their parents. This distancing approach is a strategy that E12 often uses, and she suggested applying this approach to Child Bot. E12 recommended setting limitations in Child Bot's conversations while ensuring that it still maintains a peer-like tone: *"If the chatbot could respond with something like, "I can talk for about 10 minutes because I have to do some homework," or "I can chat briefly, do you have anything urgent?" it would mimic real-life interactions and help the child feel more at ease. This kind of interaction could make the chatbot seem more relatable and approachable."* This suggestion indicates how Child Bot should set boundaries in interacting with children, just like how therapists keep their distance from child patients to promote children's relationship with their parents. Another concern that some experts expressed about the chatbot's emotional outlet role was managing children's emotions. While the experts thought Child Bot would effectively draw children's emotions out, they were worried about how appropriately it could handle the emotions: *"My concern is how well it can handle those emotions once the child opens up. I believe that when counseling, it's crucial to draw out the child's emotions and address and resolve them properly." (E13).* The experts could not recommend specific methods for how Child Bot should manage child patients' emotions effectively; however, they

emphasized the importance of addressing these emotions once they are brought to the surface.

*5.2.2 Reflection and Verification for Parents.* A chatbot can be a reflection and verification tool for parents that offers child-specific guidance. All experts agreed that one key feature of Expert Bot should be helping parents reflect on their communication practices with their children. Asking provoking questions (e.g., have you experienced similar communication issues? What did you do? How did your child react?) to parents would be crucial since they usually do not get to think about communication issues. Specifically, some experts considered scenarios useful in promoting parents' reflection. For instance, E7 described how observing hypothetical parental responses in scenarios can provide an objective viewpoint, helping parents reflect on their own behaviors and decisions: *"The scenario-based approach seems effective because it allows reflection on how to handle different situations ... This reflection can help them [parents] observe the situation from a more detached perspective." (E7).*

In addition, this third-person perspective may help parents reflect on their children's behaviors. Most of the experts observed communication issues when parents do not fully understand their children's behaviors or needs. Thus, the experts valued how the Expert Bot provides contextual information about children based on the data it receives from the Child Bot. E3, E9, and E13 specifically pointed out that the Expert Bot could help parents understand children's perspectives or reasons for their behavior (e.g., reasons for why children do not want to share about their pain) by providing how children in this age group may experience it. For instance, E9 provided an example of how healthcare providers can help broaden parents' perspectives to understand their children: *"Children at this age might think in certain ways during situations like this. But if we only present one interpretation, it might seem too narrow or biased. If we offer two perspectives—like "they might think this way, or they might think that way"—it can encourage broader thinking."* Broadening parents' perspectives on children's behaviors may help parents learn how their children interpret the world in a different way from theirs, not in a wrong way.

Another benefit parents can take from a chatbot is verifying their communication behaviors to either reassure or improve them. Unlike Child Bot, the experts envisioned the Expert Bot to provide clearer guidance and answers to parents so that parents can feel assurance or comfort about their behaviors. For example, E10 described how parents often tried to seek confirmation from healthcare providers and how Expert Bot may serve such a role: *"I think many mothers want to get some confirmation [from providers]. They believe they're doing the right thing and want reassurance. Even mothers who are doing really well often share with us because they want to hear 'You are doing great. Keep doing what you are doing.'"* Furthermore, a few experts have also pointed out that it is important to inform parents about positive changes in children's health. For instance, E14 usually shares the child patient's positive experiences with their parents to make the parents feel more assured and confident in the treatment process:*"When parents hear about these positive aspects [e.g., how children have stronger will after intense treatment], they may feel more reassured and more willing to participate in the treatment process."* This reassurance is particularly important for parents who are already effectively communicating with their children and managing their health, ensuring they can continue to do so.

On the other hand, some experts highlighted potential drawbacks of the Expert Bot's role in verifying parental behavior and providing answers. E10 cautioned that the Expert Bot should avoid judging parents' behaviors, as this could make them feel intimidated or guilty. This concern relates to a common dilemma: parents often feel guilty about not managing their children's pain adequately, while simultaneously being unsure how much to trust their children's pain reports, suspecting possible exaggeration. E13 observed this dilemma:*"But in reality, when parents ask, 'How much should we believe when our child says they're in pain?' the truth is, parents who have had their child diagnosed with something like stomach pain due to a serious condition often feel a strong sense of guilt. They feel more guilt about having overlooked their child's pain and not realizing how serious it was while raising them."* Similarly, E14 expressed concern that providing instructions to parents could be risky, as suggested approaches for managing children's discomfort could be misinterpreted and misapplied. These insights suggest that Expert Bot must balance guidance with sensitivity to avoid worsening parental guilt or misunderstandings.

*5.2.3 Assessment for Healthcare Providers.* A chatbot can be a valuable assessment tool for healthcare providers to evaluate the communication practices of child-parent pairs. All of the experts in our study perceived ARCH as a supplementary source of data on the communication styles and needs of child patients and their parents. The experts shared that they have already been using questionnaires or measurements to assess child patients' and their parents' emotional needs and communication styles. For example, E13 showed an assessment booklet that describes different activities for child patients to identify their emotions related to illness and treatment. Figure 4a describes emotional cards where child patients can choose the most important feeling to them, whereas Figure 4b asks child patients where they feel safe to share their emotions. These activities are helpful for social workers and therapists to probe deeper questions and assess how children communicate their emotions. However, keeping the children engaged with the activities through simple diagrams and texts is challenging. Thus, experts in our study envisioned ARCH might replace or enhance existing measurements since children may be more engaged with an interactive chatbot. The experts expected to gather richer information from the conversation logs of child patients.

In addition to replacing measurements, some experts also perceived ARCH as a partner in their care team who may gather information about patients and parents before the clinical consultations: *"I would imagine it is like a partnership. ... It's an assessment of needs. I think that it [ARCH] would be a partner and give us information that we get information from all kinds of different resources when it comes to the team." (E2).* In current practices, healthcare providers conducting initial consultations with child patients and parents note specific family details (e.g., child patients' interests or parental styles related to health communication). This information is shared among the care team to facilitate rapport-building with child patients and provide relevant guidance to parents. Thus, the experts viewed ARCH as a partner in gathering initial information to help providers better steer their consultations.

Furthermore, some experts specifically valued the scenario-based approach of ARCH since it may allow experts to understand how child patients and parents perceive the same situation differently. This information about potential differences can enable therapists or social workers to clarify the problem and determine how to intervene. For instance, E3 described how ARCH can utilize the scenario-based approach to identify where the potential communication issues arise from: *"It's a different story between a child who's like 'I never told my parents about a stomach ache, because I'm afraid' versus 'I've tried it [earlier], and it didn't go well' … So it's two very different problems.… If that's what's happening, then I don't think the intervention is with the kid. It's really with the parent. We first have to prevent the parent from overreacting." (E3).* Building on this quote, E3 suggested improving the current conversation flow of ARCH by considering parent-derived problems in cases where children's interventions are limited. Moreover, there are other cases where interventions with parents are necessary, particularly in Korea. For example, E15 described how Korean parents tend to focus more on the academic achievements of their children, even after intense treatment: *"Parents in Korea seem to become very sensitive about issues related to their children's academic progress and friendships once the children are recovering. If a child falls behind in their studies, many parents become quite anxious and try to make up for it by pushing their children." (E15).* This focus on education eventually leads to many situations where the child-parent relationship is characterized by nagging and avoidance. Hence, experts in our study envisioned ARCH, particularly the scenario-based approach, would be helpful to identify potential differences between child patients and parents and determine whom experts should offer guidance.

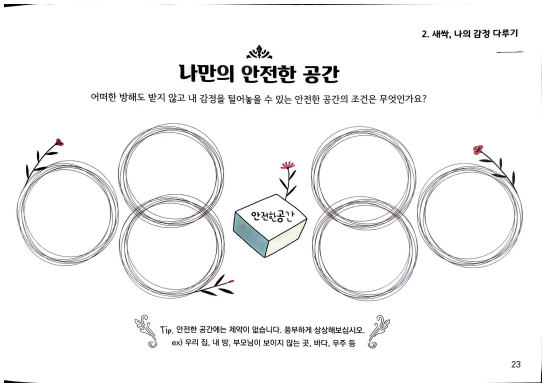
Building on the perception of ARCH as a partner, some experts explicitly mentioned that ARCH's role would not be intrusive since there would be a clear boundary for what ARCH can do and what human providers have to do. E12 believed ARCH would not replace therapists' jobs, instead reducing some of the initial assessment tasks for them: *"I don't think [ARCH] would be intrusive at all. It's different from when a person is directly involved. … There are things that AI cannot handle. There's a healing that happens when people meet face-to-face. That's something AI cannot replace unless it somehow replicates the entire human experience. … However, in medical settings where a psychological therapist isn't available, AI could be helpful. I believe it could be useful for initial assessments or interviews." (E12).* Due to this boundary, E12 envisioned that small hospitals where they lack staff could have more benefits from ARCH as it can collect information from child patients and parents and save time and human resources for initial assessment. Moreover, a few experts believed such distinctive boundaries might enable easier collaboration with ARCH. For instance, E13, a clinical social worker specializing in managing child patients' and parents' emotions, mentioned how she would work with ARCH; it can bring out the emotions of children and parents, and then she can help manage those emotions.

To better improve the partnership with ARCH, a few experts pointed out the importance of considering how to use collected information in consultations. While ARCH is beneficial in assessing communication practices of child patients and parents, healthcare providers should be careful with using the collected information in consultations. For instance, E10 shared her concerns about the potential loss of children's trust in ARCH if she were to use data collected from ARCH: *"If I [as a child] have shared my thoughts openly, thinking it's confidential, but then the counselor knows all about it, and anyone can see it, it feels like being monitored, and I wouldn't be able to talk freely."* Despite the potential benefit of using ARCH as an assessment tool, E10 pointed out a potential breach of trust that could degrade children's engagement with ARCH. Thus, it is important to respect child patients' confidential information while using the information to better steer conversations and offer more relevant guidance on child-parent communication.

## 6 DISCUSSION

In this section, we discuss the lessons learned from the design of ARCH and expert interviews, focusing on the role of AI-driven chatbots in pediatric communication. We also address the design


(a) An activity to explore child patients' emotions




(b) An activity to explore when and where child patients feel safe to share their emotions

**Figure 4: Two photos that describe activities to assess child patients' emotions are taken from a booklet provided by a clinical social worker: (a) Different emotions are represented as facial expressions, and (b) There is a question:"Where is the safe place to share your emotions? (from left to right)**

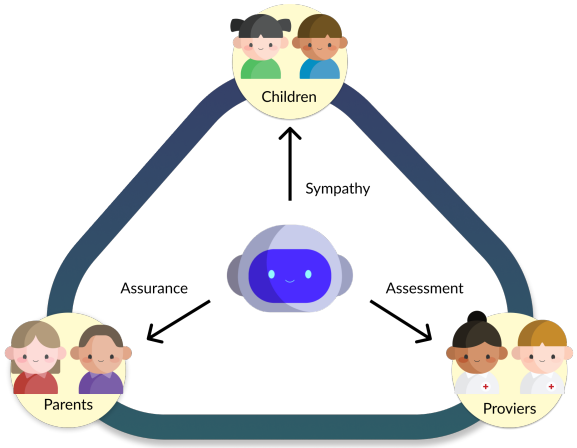



**Figure 5: A diagram that shows the communication space between child patients, parents, and healthcare providers. An AI-driven chatbot can create a space where it facilitates information sharing among stakeholders (e.g., children's emotions) to promote effective communication.**

considerations for developing AI-driven chatbots to meet the specific needs of various stakeholders in pediatric communication. Lastly, we report on the limitations of this study, potential directions for future work, and the positionality of the authors.

## 6.1 Creating a New Space in Pediatric Communication

When we designed ARCH based on the findings from our design sessions, the expected role of ARCH was to be a facilitator between child patients and parents, similar to the way experts support child-parent communication. However, our findings from the expert interviews revealed that ARCH could serve beyond this role. The experts envisioned ARCH fulfilling distinctive roles for each stakeholder, aiming to enhance the relationships among child patients, parents, and healthcare providers. These roles highlight how ARCH could meet the complex needs of each stakeholder. As shown in Figure 5, ARCH can be an outlet that sympathizes with the feelings and experiences of child patients while offering assurance to parents. For healthcare providers, ARCH can deliver necessary information for assessing child-parent communication practices.

Given ARCH's potential to meet diverse stakeholder needs, experts in our study envisioned it as fostering a more effective communication space among stakeholders rather than acting as an additional stakeholder. This view aligns with Cornett and Kuziemsky's communication space model for team-based communication in healthcare [15], which outlines five stages: purposes (e.g., education), communication practices (e.g., open/closed loop), structures (e.g., tools), processes/actions (e.g., documentation), and development of common ground. These stages demonstrate how effective communication can be achieved within care teams. Similarly, the interaction between child patients, parents, and healthcare providers can be seen as team-based, where each member has a unique role but shares the goal of promoting children's health. A key aspect of effective communication in this model is establishing common ground, ensuring that information is understood within its context [15]. Our findings indicate that ARCH can facilitate this by helping stakeholders align their perspectives. For instance, experts suggested that ARCH could help parents better understand their children's emotions. By providing scenarios (e.g., a chatbot sharing a story about not reporting a headache), ARCH could encourage parents and children to reflect on and improve their communication from a third-point perspective.

Although ARCH holds promise for fostering common ground between all stakeholders, creating effective communication spaces for child patients requires a more nuanced approach. Given their developing communication skills, experts stressed the importance of designing spaces that prioritize comfort, empathy, and support over prescriptive solutions. This perspective aligns with Carlsson *et al.*'s findings on tablet-based tools, which successfully provided safe environments for children to express their symptoms and emotions [9]. Similarly, ARCH can serve as a secure platform where child patients feel comfortable sharing their feelings and exploring communication preferences with their parents.

To effectively support pediatric communication, AI-driven chatbots must facilitate empathetic and context-aware conversations. Prior studies have highlighted the role of addressing children's emotions in healthcare settings [45, 51]. Building on these findings, we propose chatbots should go beyond simply restating children's inputs. Instead, they should be designed to account for contextual factors such as emotional fluctuations caused by care environments or medications, which ARCH's current design lacks. By incorporating these considerations, ARCH could offer a more flexible communication space that meets the emotional and informational needs of stakeholders, fostering mutual understanding and collaboration.

## 6.2 Chatbot as Dynamic, Context-Adaptive Communication Medium in Pediatric Care

Our findings highlight opportunities for AI-driven chatbots to serve as a communication medium in pediatric care. Existing health technologies for child patients often focus on providing supplementary communication tools. For example, a tablet-based drawing tool with a zooming feature helps children describe chronic headaches in more detail [25], while another uses sound effects and animations to assist children in explaining their symptoms or problems [4]. Building on these interventions that enhance children's communication skills, our findings show that chatbots can facilitate information between child patients and parents, helping to bridge gaps in child-parent communication. Although ARCH did not directly connect child-parent pairs in our study, experts viewed it as a supportive medium for improving mutual understanding. For instance, by presenting scenarios, ARCH could help parents grasp why their child might feel intimidated or anxious before clinical visits. In this way, ARCH acts as an indirect representative of the child, conveying their needs to parents. Especially, AI-driven chatbots are appropriate for adopting a scenario-based approach in communication. As noted by our expert participants, chatbots may provide more engaging and dynamic scenarios that reflect children's experiences and responses compared to a paper-based approach. For instance,

emotional cards (Figure 4a) are useful for experts to open up conversations with child patients about their emotions. However, children often get used to these paper-based approaches and lose interest easily. A scenario-based approach facilitated by an AI-driven chatbot may increase child patients' engagement through free-form conversations and provide more opportunities to identify children's dynamic needs that may vary in each communication encounter with parents and providers.

To further enhance child-parent communication, chatbots should account for the unique dynamics of their relationship. In pediatric care, this relationship involves both the child-parent bond [47] and the patient-caregiver dynamic [34]. Given this complexity in the dyadic relationship, chatbots should tailor their guidance to the specific dynamics and challenges of each dyad. Experts in our study noted that communication issues can arise from either child patients or parents, underscoring the need to understand their mutual interactions and habits. Our findings emphasize the importance of considering the dynamics of the child-parent relationship to improve pediatric communication. To better understand child-parent relationships, emerging AI techniques, such as persona attribute extraction [62, 65], could improve the capabilities of chatbots by adapting to the personas of both the child and the parent during conversations. The child's attributes may influence a parenting-side chatbot's persona, and vice versa. For instance, based on the information collected by Child Bot about an intimidated child, Expert Bot could provide more nuanced guidance to parents, such as acknowledging the child's behaviors rather than focusing on their mistakes. Furthermore, chatbots could be designed to ask more targeted questions about existing communication practices. Sample questions may include how health topics are discussed (e.g., explaining treatment plans or symptoms) and how parents typically respond to their children's emotional expressions (e.g., offering comfort during medical anxiety or validating feelings about medical procedures). By gaining a deeper understanding of the child-parent relationship, AI-driven chatbots could offer more tailored, dyad-specific communication guidance.

## 6.3 Trade-offs in Chatbot Interactions

Drawing on our findings, we identified three key trade-offs in designing AI-driven chatbots for pediatric communication that address the diverse needs of child patients and their parents. The first trade-off revolves around balancing the protection of children's privacy with the need to share their information with parents and providers. This trade-off emerged from the design sessions with child patients and parents. Although we attempted to address this trade-off by creating two separate chatbot instances, some experts in our study still perceived the issue in our prototype. As noted in the findings, most of the experts valued how ARCH could identify children's inner voices – insights that would otherwise be difficult to gather in person. However, some experts expressed concerns about using potentially sensitive information that was shared during the child-chatbot interaction for their consultations, fearing it might undermine children's trust in ARCH. In light of this, a potential way to address this trade-off is nurturing children's trust in the chatbot for information sharing. Some experts suggested that Child Bot could explicitly ask child patients for consent before sharing their information with parents and healthcare providers, offering an opportunity to empower children to manage their data. Building on this insight, we suggest a child-centered approach for sharing children's information through ARCH or similar chatbots. This process would give child patients a sense of agency over their stories by deciding which topics they are comfortable sharing and which they prefer to keep confidential. Thus, chatbots can protect privacy while still providing essential information to parents and healthcare providers. This approach mirrors the existing token-based prototype in child patient-clinician communication, where children choose a "token" to indicate the topics they wish to discuss with their doctors [5]. By adopting a similar method, chatbots can empower children to control the flow of information to curate their experiences with their illness. Hence, chatbots can foster both trust and privacy while still ensuring that critical health information is shared with parents and healthcare providers.

Second, a trade-off between children's engagement and disengagement should be considered. As some experts in our study noted, Child Bot would enable child patients to be more engaged in conversations about their emotions or experiences compared to existing paper-based resources. However, similar to how experts maintain a certain distance from child patients, Child Bot should also establish clear boundaries when engaging with children. This concept of boundaries aligns with concerns about potential overreliance on healthcare chatbots reported in prior studies (e.g., young adults [30], children [51]). These studies suggested increasing in-person meetings with counselors or offering cognitive activities to encourage users to reflect on their behaviors, thereby reducing reliance on chatbots. In pediatric care settings, however, such approaches may not be as effective, as the process of setting boundaries should be gradual from a child's perspective. As E12 suggested, Child Bot or similar chatbots should impose limitations on conversation time with child patients while maintaining a peer-like tone. For instance, a peer patient chatbot could tell children that it only has 10 minutes to talk, as it needs to visit a clinic. This active behavior by the chatbot would help minimize overreliance on the chatbot while providing children with an emotional outlet.

Third, a trade-off between providing general guidance and specific guidance to parents should be considered. Previous studies have highlighted opportunities for chatbots to promote parental skills or provide relevant parenting information [19, 41, 64]. For instance, Entenberg *et al.*, [19] designed a chatbot to teach parents how to use positive attention and praise to encourage positive behaviors in their children. Their randomized control trial demonstrated that the chatbot intervention was promising in promoting parental skills. These existing chatbots typically offer general guidance and resources, as they are designed for a broader audience. However, our findings present the need to carefully consider the level of parental guidance provided. Experts in our study suggested that Expert Bot should offer assurance to parents on their communication practices with child patients, but the level of detail in this guidance must be appropriate. If the guidance is too general, parents may find it unhelpful and fail to reflect on their practices; if it is too specific to a particular situation, parents may feel intimidated if their practices differ from the guidance. To provide the right level of guidance, Expert Bot or similar chatbots should offer multi-layered support, starting with general advice and progressing

to more specific recommendations. For example, the chatbot could provide general guidance on managing a 10-year-old's responses, and upon further inquiry (e.g., "Can you give examples?"), offer more detailed advice.

## 6.4 Cultural Considerations for Designing AI-driven Chatbots in Pediatric Communication

Our findings also revealed potential cultural differences that should be considered when designing AI-driven chatbots to support pediatric communication. While detailing cultural differences in chatbot use during child-parent communication was beyond the scope of our study, we uncovered two nuanced insights that underscore the importance of cultural context in designing AI-driven chatbots for pediatric communication. These insights suggest potential opportunities for creating more culturally appropriate chatbot interactions.

First, our expert participants shared how Korean parents' interests in their children's academic performance often cause problems in child-parent communication. These problems occur when parents steer their conversation with child patients, focusing on how to keep up with the school curriculum. These findings show the necessity for AI-driven chatbots to consider the main conversation topics relevant to each culture. Previous studies in the medical literature have presented how cultural factors may impact health communication [21, 31, 38, 55, 60]. Some studies have particularly highlighted how cultural factors (e.g., insufficient cultural healthcare education, stigma associated with culturally perceived illnesses) impact pediatric care in general and parent-provider communication [21, 60]. To provide more culturally effective care, healthcare providers must understand and respect the role of family, concepts of time and fate, and social structures in different cultures [20]. Adopting this suggestion, AI-driven chatbots should respect the cultural aspects of child-parent communication to better facilitate interactions around pediatric care. Our findings suggest a potential direction for future studies to explore how AI-driven chatbots can be designed to facilitate culturally effective health communication.

Second, medical institutions and professions differ among countries. We recruited expert participants from three organizations in two different countries. Different roles or occupations can exist depending on the organization, even when they perform similar tasks. For example, in general, social workers in Korea tend to focus more on providing policy- or funding-related resources to patients and caregivers. However, the clinical social workers we recruited in Korea (E9, E13, E14) were specifically affiliated with a pediatric care team. Thus, one of their main tasks was to provide emotional and educational support to child patients and their parents. Therefore, such differences should be considered when designing an AI-driven chatbot so that it can better serve its role as an assessment tool for healthcare providers. In pediatric cancer care, cultural issues extend beyond ethnicity or race to include professional cultures, which can lead to communication failures [52]. Such occupational cultures (differing roles and occupations) may need to be considered when designing AI-driven chatbots. Even when similar tasks are performed, AI-driven chatbots like ARCH should provide appropriate and different information to healthcare providers, depending on their roles and tasks. In this way, the chatbots can be used as an assessment tool, as our experts wanted ARCH to be. To better understand how chatbots can address occupational differences, future studies are needed to explore the various roles and professions in pediatric communication.

## 6.5 Limitations and Future Work

Our study has some limitations to note. First, given its qualitative nature, the findings are specific to the context of pediatric cancer. Since communication methods, topics, and goals may differ in each disease context, further research is needed to explore how parents, children, and healthcare providers communicate health-related information in other care settings (e.g., heart disease, diabetes). Nevertheless, our findings strongly suggest the potential of chatbots in enhancing triadic communication in broader pediatric care contexts, as child patients may face similar communication challenges with parents and providers. Second, muti-site recruitment was a contigency plan for recruitment challenge. With more focus on communication practices, examining detailed cultural differences in pediatric communication currently falls outside the scope of this study. However, including participants from the United States and Korea enabled us to capture a broader range of insights and enhance the robustness of this study. Our findings provide valuable insights from diverse expert perspectives on AI-driven chatbots. Drawing on these insights, we suggest that future research is needed to develop AI-driven chatbots tailored to pediatric care in various cultural or institutional settings. Third, we recruited children in different stages of treatment for design sessions. Although we identified common communication issues, child patients may have specific needs depending on their current stage of treatment. Future studies are needed to incorporate these needs into AI-driven chatbots. Lastly, we gained insights from experts who primarily provide emotional support and education in pediatric care. To better understand the role of AI-driven chatbots in pediatric communication, it is necessary to extend perspectives to include physicians and nurses, even though their focus is more on medical information.

## 6.6 Author Positionality

The research team's diverse backgrounds and international connections enabled effective multi-site recruitment across Korea and the United States. The first author is an experienced researcher in healthcare HCI who bridges both cultures, having originated from Korea and lived in the United States for over 10 years, including seven years focused on HCI and healthcare research. He is currently based at a U.S. university but has also worked at a Korea-based research institution. His bicultural background and established relationships with healthcare providers in both countries not only facilitated data collection and recruitment but also provided crucial cultural insights during data analysis, helping to interpret findings within their appropriate cultural contexts. The second author is a senior research scientist based in Korea, specializing in personal health informatics and AI system applications for marginalized populations. His extensive network with Korean healthcare providers, particularly psychologists, was instrumental in recruiting participants from Korean medical institutions. The last author is an associate professor at a U.S. university with extensive experience in HCI and healthcare. Her expertise in U.S. healthcare systems

provided critical perspectives for analyzing U.S.-based data. The remaining four authors, also based in the U.S. and affiliated with the same university as the first and last authors, contributed additional perspectives on U.S. healthcare contexts during data analysis. The team's diverse backgrounds enabled rich discussions during data analysis, helping to uncover universal themes and culture-specific insights in pediatric communication.

## 7 CONCLUSION

We conducted two studies to design ARCH, a chatbot prototype aimed at enhancing pediatric communication. First, we held design sessions with 12 children with cancer and their parents to inform the development of ARCH. Second, we interviewed 15 pediatric care experts, who helped identify three key roles for the chatbot: providing an expressive outlet for children, offering reassurance to parents, and serving as an assessment tool for healthcare providers. Our study makes two important contributions: (1) we provide empirical insights into how an AI-driven chatbot should be designed and placed within pediatric communication, and (2) we present design considerations for AI-driven chatbots that create effective communication spaces, address the diverse needs of stakeholders, and accommodate cultural differences. Based on our findings, we encourage researchers in the CHI community to further investigate both the opportunities and challenges of using AI-driven chatbots to facilitate communication between child patients, their parents, and healthcare providers.

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