Chatbot for social needs screening and resource sharing with vulnerable families: Iterative design and evaluation study

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Abstract

Health outcomes are significantly influenced by unmet social needs. Although screening for unmet social needs has become common in healthcare settings, there is often poor linkage to resources after needs are identified. The structural barriers (e.g., staffing, time, space) to helping address social needs could be overcome by a technology-based solution. This study presents the design and evaluation of a chatbot, DAPHNE©, that screens for social needs and links patients to resources. This study used a two-step approach: (1) iterative design with interdisciplinary stakeholder groups and (2) feasibility and usability assessment. Virtual sessions were held with an interdisciplinary group of stakeholders (n=10) using thematic and content analysis to inform the chatbot's design and development. Evaluation included an online survey, focus group interviews, and scenario-based usability testing with community health workers (family advocates) (n=4) and social workers (n=9). The stakeholders emphasized the importance of provider-technology collaboration, inclusive conversational design, and user education. Users found the chatbot's capabilities met expectations and the chatbot was easy to use (System Usability Scale score=72). The stakeholders raised concerns about accuracy of suggested resources, electronic health record integration, and trust with a chatbot. Future research should examine effectiveness, cost-effectiveness, and scalability of chatbot interventions to address social needs.

Keywords: social determinants of health, social needs, chatbot, conversational agent, primary care, digital health, iterative design, implementation, evaluation, usability, feasibility

Introduction

Social needs (e.g., food insecurity, housing insecurity, transportation challenges, economic instability) are strongly associated with poor health outcomes[1] and perpetuate health inequities.[2,3] Children are especially at risk when families face unmet social needs, as nearly 10% of pediatric primary care patients identified with at least one social need.[4] Driven by recent recommendations, there has been rapid uptake of social needs screening.[3,5] Although screening can be relatively straightforward, linkage to resources to address social needs remains as a major challenge.[6,7]

Typically, clinicians will provide families with social needs a resource sheet. Families are then responsible for follow-up. Most clinics do not have social workers or other staff to help families access services and to help overcome barriers, such as language or cultural differences, financial constraints, transportation issues, limited internet access, or lack of awareness about available resources. Thus, families are often left to navigate the complex world of social services independently, which can result in significant difficulties in obtaining much-needed assistance and support. Therefore, the passive provision of information is rarely effective. It is imperative to develop scalable strategies that could screen for social needs and effectively link to services.

Digital health technology (DHT) could improve both screening and referral to resources and assist to vulnerable populations.[8] Currently, Electronic Health Records (EHRs) can help facilitate screening and patient portals can help with bidirectional communication.[3] However, this does not eliminate the need to maintain lists of resources and the need to help with linkage to resources. Semi-autonomous intelligent and conversational DHTs, such as chatbots (conversational agents or dialogue systems), can help to address these gaps. By employing machine learning algorithms and natural language processing, chatbots can deliver personalized feedback and health recommendations to a wide range of users via interactive, user-friendly interfaces that are designed to maintain human conversation.[9,10] The capacity of the technology to reach and assist a large number of users simultaneously offers a cost-effective and efficient method for delivering personalized health services.[11,12] Chatbots have been used for healthcare communications, including health information seeking, health screening and support, and to improve adherence to recommended care.[13–18] Chatbots can facilitate social needs screening and provide personalized resources to families outside of the traditional clinic setting via speech or text, and could improve access,[19,20] and further contribute to increased understandability and personalization while addressing social needs.[21,22] In this study, we report iterative design, development and evaluation of a chatbot, DAPHNE©, for social needs screening and resource referral.

DAPHNE chatbot

DAPHNE is a web-app available via a computer or iOS/ Android based mobile devices over a web browser. Figure 1 presents the initial wireframe concept. The DAPHNE conversational interface prototype was designed using Adobe XD, Expo and JavaScript with a secure text-to-speech and speech-to-text service for voice interaction using Amazon Web Services (AWS). Conversational flow was designed to be rule-based.

Figure 1: Initial wireframes and mock-ups

The architecture, including data storage, conversational intelligence, information search and referral services, uses AWS and Microsoft Azure backend services. DAPHNE leverages Application Programming Interfaces (API) provided by community resource platforms to access resource databases. These platforms, such as FindHelp.org, 211.org and Cap4Kids.org provide information about community resources categorized by geographic region. DAPHNE's architecture is designed to be integrated with EHR, enabling the communication of social needs screening results to healthcare providers (HCP) such as social workers, community health workers, and care teams. Its functionalities are listed in Table 1. In the scope of this study, the resource database of DAPHNE was locally created for testing purposes, without leveraging real-time API connection to the community resource platforms. Also, the prototype was limited to screen one social need to reduce complexity during the testing. We focused on food insecurity since it is the most common unmet social need.[23]

Table 1. DAPHNE chatbot functionalities

Functionality	**Description**
Profile page	Users create their account and setup profile details including, name, ZIP code, family type/size and income level. The information is to be used for resource finding queries.
Avatar	Users can create an avatar to personalize their chatbot experience For the prototype, we used Apple's Memoji to create an avatar that dynamically reflects emotions.[24]
Language selection	Users can select their preferred language. The prototype included the following languages: Somali, Nepali and Spanish
Audio narration	Users can use text-to-speech and speech-to-text feature to enable audio entry and engagement and listen the responses
Multimodal input	Users can use voice input (using speech to input), assistive buttons pre-

	populated responses to select, text entry with free text form to interact with the chatbot
Social needs screening	DAPHNE uses the following standardized questions [4] to guide screening process: Food: Within the past 6 months, you worried that your food would run out before you had money to buy more. Housing: Do you think you are at risk of becoming homeless? Transportation: In the past 12 months, has lack of transportation kept you from medical appointments or from getting medications? Utility: In the past year, has the utility company shut off your service for not paying your bills?
Interactive resource sharing	DAPHNE can search the resource databases and present matching resources based on user response and ask follow-up questions.
Check-in and reminder notifications	DAPHNE can send notifications. Scheduled check-in: it can collect information if the resource shared was useful or not. Reminder: it can set and send reminders if the user would like to engage in another time. (See Figure 1 for reminder notification example)

Figure 2 outlines the chatbot ecosystem framework. Within the scope of this study, we are focusing on iterative design and evaluation of engagement using conversational interface (Figure 2.A). In the next phases, DAPHNE will have backend cloud services and API connection to access to online resource databases (Figure 2.B), provider dashboard to track engagement, control content (Figure 2.C), and integrate to medical records to report back SDH monitoring (Figure 2.D).

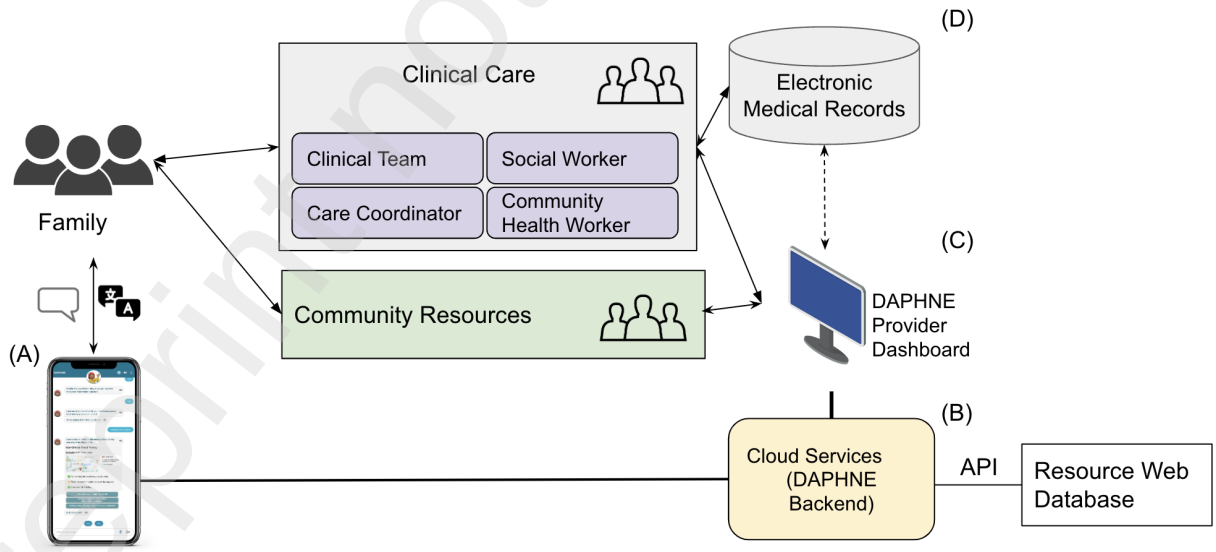

Figure 2. Conceptual framework of the chatbot ecosystem

Method

Study design and participants

The study is divided into two main parts: (1) designing the chatbot and (2) evaluating its feasibility and usability. We used a stepwise user-centered iterative and participatory development and improvement processes to ensure the proposed technology meets needs and expectations. Figure 3 presents the design, development and evaluation stages.

Figure 3: Study process diagram

Study 1 focuses on iterative design which includes the stages of ideation, prototyping, and refinement.[25,26] We held virtual sessions with an interdisciplinary group of stakeholders. The sessions focused on answering the following research questions to understand design preferences and needs: *"What are the pain points in current practices of social need screening and resource sharing?", "Why should we use or not use technology to facilitate this process?", "How can we design and use a chatbot to connect with families in primary care settings in order to address social needs effectively?"* For the iterative design session, an interdisciplinary stakeholder group (n=10) was formed internally at the Nationwide Children's Hospital, including public health specialist (n=1), primary care physician (n=1) and nurse (n=1), social work director (n=1), community health work specialist (n=1), public health scientist (n=1), industry partner leadership (n=1), community partner leadership (n=1), family advocate (n=1) and information system expert (n=1). Stakeholder group members were recruited within the NCH network (including primary care clinics) in September 2022.

Study 2 is evaluation of the prototype. It was informed by the feasibility framework,[27] technology acceptance model [28] and a usability scale, Usability Metric for User Experience - Lite (UMUX-Lite) [29]. We collected data via a focus group interview with community health workers (who are also family advocates as part of the community), and online survey and scenario-based usability testing with social workers to examine the usability and feasibility of DAPHNE (semi-functional prototype) for families and communities. For the evaluation, the participants included community health workers (n=4) and social workers from clinics (n=9). They were recruited within the hospital network via email or phone (January-February 2023). Participation was voluntary with no monetary compensation provided. This study is not considered human subjects research and exempt from ethical board review (Nationwide Children's Hospital Institutional Review Board).

Data collection and analysis

Iterative design sessions consisted of interactive interviews with open discussion guided by the research questions and moderated by a researcher. Wireframes were used to communicate initial design and revised designs of the chatbot (see Figure 1). In total, three 1-hour sessions of stakeholder interviews were held between September-December 2022. The research team continuously communicated with the stakeholder group via email to share iterative improvements in the prototype. Throughout the sessions and conversations, stakeholder feedback was captured as conversation notes and observational notes. We conducted content analysis to inform the chatbot development process.[30]

The data collection protocol for the evaluation process was guided by the technology acceptance model,[28] usability scale [29] and feasibility framework.[27] Social workers at NCH were invited via email for their participation in an 20-mins online scenario based study to use the chatbot prototype and provide feedback. Community health workers were invited to a single-session focus group interview at the hospital (~1 hour). The interview was initiated by introduction of each member, communicating the social needs, the services, opportunities and challenges. Second, the study team introduced the chatbot, shared examples, functionalities and a scenario-based demonstration. Usability questions and questions about dialogue and conversational design, voice interaction, perceived opportunities and barriers were verbally discussed, which followed a similar to online survey instruments.

Thematic analysis was used to synthesize the qualitative data and to understand the meanings and experiences reported in response to open ended questions and captured during the interviews.[31] Thematic analysis was conducted by two researchers independently. Researchers discussed and built a consensus, and resolved discrepancies whenever present with inclusion of another study team member. Usability measure was adapted from UMUX-lite, with an expected SUS score of 60 or above.[29,32]

Results

Study 1 - Iterative design

We conducted three interview sessions with the stakeholder group (n=10). Table 2 outlines the questions and themes for each question.

Table 2. Themes from stakeholder group sessions

Questions	Themes
"What are the pain points in current practices of social need screening and resource sharing?"	• **Inadequate or inconsistent screening tools:** The tools used for social need screening may not be comprehensive enough for addressing all social needs associated with SDH, resulting in incomplete assessments. Additionally, there might be inconsistency in the use of these tools across different settings, leading to variations in the identification and understanding of social needs. • **Limited provider training and awareness:** Healthcare providers and other professionals involved in social need screening may lack sufficient training and awareness about how to implement and screen, and also address the needs. This can lead to lower quality of service as well as adversely affecting quality of life. • **Fragmented systems and lack of integration:** Social need screening and resource sharing efforts are often fragmented across different divisions, departments, and organizations. This can lead to poor communication and collaboration, creating barriers to the effective identification and provision of resources. • **Insufficient resources and capacity:** There may be a lack of adequate resources and capacity to address identified social needs based on the location and resources of institutions (rural vs urban health institution), resulting in unmet needs or long waiting periods for support. This can exacerbate existing disparities and negatively impact health outcomes. • **Stigma and privacy concerns:** Patients and families may be reluctant to disclose their sensitive information as well as their social needs due to concerns about stigma or privacy. This can prevent accurate identification of needs and hinder access to appropriate resources. • **Cultural and linguistic barriers:** Cultural and linguistic differences may negatively impact communication among providers and patients/ families, leading to misunderstandings and underestimation of social needs. This can result in

	the inadequate provision of resources and support.
"Why should we use or not use technology to facilitate this process?"	**Opportunities** • **Improved efficiency:** Technology can streamline the screening and resource sharing process, reducing the time and effort required by both providers and patients/families. Automated systems and digital platforms can facilitate data collection, storage, and retrieval, making it easier to identify and address social needs at scale especially within low resource settings. • **Standardization and consistency**: Digital tools can help ensure that social need screening is conducted in a standardized and consistent manner across different settings, reducing variations in the identification and understanding of social needs. • **Personalization and customization:** Technology can enable more personalized and customized approaches to social need screening and resource sharing, tailoring interventions to the specific needs and preferences of patients and families (which can be beneficial considering cultural appropriateness, language options). **Challenges** • **Digital divide:** The use of technology may exacerbate existing disparities in access to digital tools, particularly among vulnerable populations. This can result in the further marginalization of those who may be most in need of support yet do not have access to the necessary technology. • **Privacy and security concerns:** Storing and sharing sensitive data and private information electronically can raise privacy and security concerns for individuals and institutions. It might be particularly concerning if appropriate safeguards are not in place to protect the information by the technology providers. • **Implementation challenges:** Introducing a new approach with technology into social need screening and resource sharing processes may involve significant financial and human resource investments to initiate, as well as creating barriers or burdens related to staff training, infrastructure, and technological compatibility.

"How can we design and use a chatbot to connect with families in primary care settings in order to address social needs effectively?"	• **Leveraging Provider and technology collaboration,** which means that chatbot and healthcare providers (e.g. primary care team) and community centers can work together to serve families better and more effectively.
	  • Suggested use case 1: Chatbot as a triage follow-up tool that healthcare providers and community centers can "prescribe" to follow up after their visit, to ensure patient and family needs are met, and resources are useful (or not). So that chatbot can inform providers timely to intervene in case of unmet needs, as well as help to identify invalid or non-eligible resources, and update their resource list and database accordingly.
	  • Suggested use case 2: Chatbot as a pre-screening tool to inform providers and community centers about what needs to be communicated with families, and getting ready for detailed conversation about the resources and how to access them. The chatbot can ease the process of support and patient engagement so that providers can serve more families timely and spare more time to engage as well as for identifying and addressing urgent needs during their conversations.
	• Conversational design could be guided to be more **inclusive and personal**
	  • Current screening instruments are not individually relatable or personal, and chatbot can be guided toward more conversational personalized screening, which can eventually inform current screening tools. Reframing dialogues towards positive attitude and social norms are some of the methods discussed.
	  • Cultural appropriateness and language barriers could be addressed by chatbot providing language options (e.g. Ohio has a high rate of Nepali and Somali refugees with limited English proficiency and requires interpreter services) and culturally guided and appropriate conversations and dialogue flow, accounting in cultural norms and connotation (e.g. In some cultures "free resource" still may mean you have to pay back due to cultural expectations or practices).
	• Chatbots can help **educate families** about accessing resources (beyond sharing the resource, guiding for self-referral, how to check eligibility, how to navigate online resources…). This may eventually reduce dependency on low risk or quickly accessible resources by families and patients, reserving time and resources of health institutions and community centers to be spent with patients and families having urgent needs or complex needs.

Themes included common pain points, technology opportunities and challenges, and technology considerations, including inclusivity, personalization, and information about accessing resources. Based on stakeholder feedback, we improved our chatbot design as well (Figure 4). We updated the prototype to include chatbot language options, modified language (e.g, "What makes it hard to get food?"), and resource education options (eligibility criteria, documentation requirements, and referral guidance). These components are initiated, and further under development.

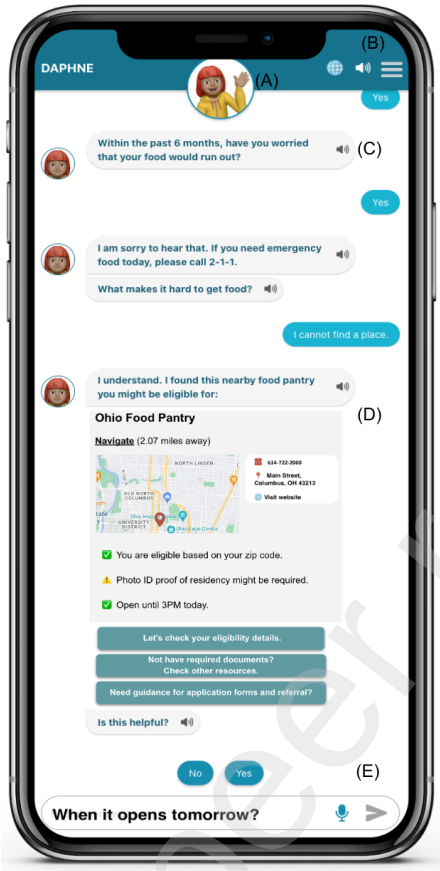

Figure 4: Revised semi-functional prototype (web app). (A) Customizable avatar, (B) Profile and setting menu, language selection and enable/disable audio narration (text-to-speech), (C) repeating audio narration for preferred messages, (D) interactive resource screen with navigation and communication details and follow-up questions suggested by stakeholders (E) assistive buttons for quick response, or text entry or speech-to-text for voice interaction.

Study 2 - Prototype Evaluation

We collected feedback from 13 participants including community health workers (n=4) and social workers n=9) within the NCH network (Table 3). Community health workers consisted of a relatively young population with one to three years of professional experience to support families. They had limited experience with chatbots and conversational agents. They are supporting families through the Connecting Families 4 Success program at NCH which provides resource linkages to families with identified social needs. The majority of social workers were 25-34 years old (n=4, %44), with one to five years of experience in their current profession (n=4, %44) in primary care, community wellness, and research. Most had prior experience with chatbots (n=8, 89%). Social workers are serving an average of 165 patients or families monthly. The majority rated that the chatbot's capabilities met expectations to address social needs (n=8/9) and its ease of use (n=8/9) as average to high (scores ranged from three to seven, and achieved an average of 72 SUS score).

Table 3: Social worker demographics

	Social worker (n=9)	Community health worker (n=4)

Have you ever used chatbots before for any purpose?	n	%	n	%
Yes, multiple times	7	77.8	1	25.0
No, never	2	22.2	3	75.0
Age group				
18-24	1	11.1	2	50.0
25-34	2	22.2	1	25.0
35-44	3	33.3	1	25.0
45-54	3	33.3	0	0.0
Experience				
Less than 1 year	1	11.1	2	50.0
1-5 years	3	33.3	1	25.0
5-10 years	3	33.3	1	25.0
10-20 years	1	11.1	0	0.0
More than 20 years	1	11.1	0	0.0
Department				
Social work	3	33.3		-
Community Wellness	2	22.2	4	100
Primary care	4	44.4		-

We analyzed responses from community health workers and social workers together to identify the themes about DAPHNE from their collective viewpoint. The themes were informed by the interview and survey questions, focusing on user experience (meeting expectations, ease of use), chatbot dialogue, audio interaction, perceived advantages and disadvantages, and integration to clinical workflow. We identified 4 themes: user experience, desired features, resource concerns, perceived disadvantages and challenges (Table 4). In addition to above average usability score (SUS score = 72), qualitative data showed that the chatbot is perceived to be useful for families and providers, and can help with social needs and resource sharing. Social workers and community health workers had a positive impression on the chatbot overall, yet they reported mixed feedback on resource accuracy, availability, challenges and EHR integration. These themes overlapped with stakeholder groups (i.e, digital divide, language barriers and conversational dialogue design).

Table 4: Themes from interviews and online survey feedback

Themes	Details
User Experience	● Conversational interface was found to be simple and understandable. It is noted as "easy to use" as it enables turn based conversation via natural language through text messaging like interface with the option of voice interaction.

	• The simplicity of the dialogue was appreciated, although some suggested adding more options and details about resources, such as, expanding options for eligibility details, required documents and forms. Even though these components were included during the iterative design process, they were not functionally adapted in the prototype during the testing.
Feature preference	• There was mixed feedback on whether audio narration would be preferable. Some participants thought it would be helpful, especially for those who face language barriers, have difficulty reading or writing, or physical impairment. However, others believe that families may prefer text or typing in certain cases, such as public places. • Several participants mentioned the importance of offering multiple language options to engage with a diverse population and non-English speakers. Current service limitations and inability to follow-up due to language barriers necessitates such alternative support on communicating social needs. • Opinions on integrating chatbot data with EHRs were mixed. Some participants supported integration for better decision-making and follow-up, while others were concerned about privacy, consent, and the potential for surveillance or stigmatization
Resource concerns	• Participants expressed concerns about the accuracy of resources and how to ensure up-to-date resource information. The concerns were also about identifying relevant resources to specific age groups or situations, which may not be available in a single database or web resource. In the current practice, support teams (e.g., community centers, social work) need to reach out and check availability of resources (e.g. food pantry) and eligibility to ensure the resource provider is operational before referring to a patient and family. The participants emphasize that any technology need to ensure resources are up to date, and with given mechanisms, they were skeptic that it is achievable with technology capabilities (given the necessity of calling and communicating with the service providers to ensure resource list is up-to-date)
Perceived Disadvantages and Challenges	• Some participants expressed concerns about the chatbot's major communication limitation, which is its inability to assess nonverbal cues, understand nuanced situations, and therefore, may not be able to articulate social need details to guide for appropriate resources. • Limited access to technology, broadband or Wi-Fi, or mobile devices could pose challenges for some families. • It is noted that some families or patients might be uncomfortable sharing personal information with a chatbot or might not trust the information provided by a chatbot.

Discussion

We reported a two-stage iterative design and evaluation study with a multistakeholder group, focusing on the development and evaluation of a social needs screening chatbot for families. Our study highlights the importance of user-centered iterative design and development of chatbots for social needs. Engaging stakeholders, including healthcare providers and family advocates, throughout the design and development process helped identify specific needs, preferences, and potential barriers to adoption. Furthermore, stakeholder feedback informed the experience and evaluation of the chatbot. It was a promising step forward enabling providers and community partners to work together to serve families effectively via conversational systems. [33,34]

In the current healthcare ecosystem, chatbots may serve a dual function as follow-up tools and triage systems, as recommended by healthcare providers and community centers subsequent to family visits, ensuring the effective utilization of resources and to meet social needs. In line with that, chatbot data can be used for timely feedback to healthcare systems about unmet needs as well as to facilitate the updating of resource repositories and databases (e.g., user feedback on non-operational food pantries). When deployed as pre-screening instruments, chatbots can enable providers and community centers to be adequately prepared for comprehensive discussions about resource availability and access, thereby streamlining support procedures. Conversational design can be strategically geared towards providing more inclusive and personalized needs-assessment.[35–37] By enhancing the relational capacities of a chatbot [38]—including positive attitudes and social norms (e.g., "Others have found assistance through this local agency."), and implementing behavioral nudges (e.g., "Completing this screening will require just a few minutes.") within the conversational design, its engagement abilities can be bolstered. In addition, a chatbot can address cultural compatibility and linguistic barriers by providing multilingual options and culturally-sensitive dialogues.[39] In the context of current practices to adequately address social needs,[40] chatbots can act as supportive adjuncts, supplementing and enhancing these efforts. Furthermore, chatbots can play an educational role in assisting families in understanding and accessing resources, steering them through self-referral processes, eligibility assessments, and online resource navigation. As a next step, chatbots can be instrumental in augmenting health literacy,[41] as they have been well-received in addressing social needs among populations with low literacy levels.[22].

Our descriptive analysis showed a diverse range of participants in terms of age, experience, and department affiliation, providing a rich perspective on the chatbot's applicability across various professional contexts. Participants have generally rated the chatbot's capabilities and ease of use as average to high. The results of our study indicate that the chatbot designed for addressing social needs is generally well-received, with most users finding it easy to use and having a positive user experience overall. This overlaps with current trajectory with chatbot use in healthcare, as their capability increases as well as usefulness.[42,43] Audio narration emerged as a theme with mixed opinions. While some users believed it could benefit those facing language barriers or with difficulty reading, others felt that text-based communication would be more appropriate in publicly available spaces, which was also noted previously as a common concern on using voice interaction in health information exchange.[44] Resource accuracy and availability were identified as concerns by participants, emphasizing the importance of regularly updating resource information and ensuring that resources are relevant to specific age groups or profiles. Integration with EHRs received mixed feedback, with some users supporting the idea for better decision-making and follow-up. Such implementation is principally viable to support decision making with a feedback mechanism.[45] Others expressed concerns about privacy and potential stigmatization, which may lead to labeling and internalized negative stereotypes that may reduce disclosing social needs.[46] Therefore, EHR integration and adoption requires detailed investigation to reduce barriers and inequality in medical documentation.[46,47] Participants raised several disadvantages and challenges related to the chatbot's ability to assess nonverbal cues and accurately screen needs, limited access to technology, and trust issues when sharing personal information with a non-human source. In that regard, using a single modality communication medium (no visual exchange) might limit chatbot ability to process nonverbal cues. Multimodal approaches with chatbots may overcome this limitation in the future.[48]

Chatbot's dependency on technology platforms (computer, Wi-Fi, or smart mobile devices) and data plans may limit access. This underscores the importance of considering the digital divide and accessibility challenges when designing and implementing chatbots for social needs. In earlier studies, IVR systems and chatbot over text messaging have been viable alternatives, which might be adapted for social needs screening and resource sharing.[49] The trust between chatbot and families might negatively influence the use. Some participants expressed concerns about sharing personal information with a non-human actor or not trusting the information provided by the chatbot. Literature has mixed evidence towards trust between humans and chatbot,[50] and further research can inform the trust built between families and chatbot.

Future work

It is essential to evaluate the long-term effectiveness, scale-up capability to increase access resources, and impact of chatbots for addressing social needs through rigorous and comprehensive evaluation methodologies.[51,52] Our study provides preliminary evidence on the iterative design and evaluation of the chatbot for addressing social needs (focusing on food insecurity screening and resource sharing with text and voice interaction). However, future research should investigate the impact of chatbot interventions on users' health outcomes, quality of life, and access to resources, as well as the cost-effectiveness and scalability of such interventions. While chatbots can play a valuable role in addressing social needs, they are unlikely to replace human service providers entirely. Instead, chatbots can be considered complementary tools that support and enhance existing services by providing timely, personalized, and accessible information and resources. Future research should explore the potential synergies and integration opportunities between chatbots and other digital health interventions, such as telemedicine, mobile health apps, and online support groups, to maximize the overall impact on users' health and well-being.

Technical capabilities

With the rapid advancements in AI technologies, especially transformer-based large language models, AI-enabled conversational agents have become more capable to perform a variety of tasks.[53,54] The barriers to developing such intelligent chatbots have been significantly lowered. These AI-powered chatbots include a large range of functionalities that set them apart from their predecessors, such as: i) engaging in discussions across multiple topics, ii) managing multi-turn conversations, iii) retaining information from previous conversations, iv) operating in both task-based and non-task-based modes, and most importantly, and v) collaborating effectively with users. In particular, being able to work together with users, listening to their instructions and understanding their preferences through naturally occurring conversations open up a wealth of opportunities for both healthcare providers and families with social needs. Although there are major concerns related to the reliability and accuracy of their responses,[55] we can expect the development of hybrid solutions leveraging the remarkable conversational competence of AI-enabled chatbots while being constrained by the strict specifications of a rule-based system. In addition, current guidelines and practices for developing skills to engage in sensitive conversation, like food insecurity, can be informative for AI enabled chatbot development.[56,57] For instance, AHA's guidelines suggesting cultural competency, motivational interviewing, active listening and empathic inquiry would be valuable input for conversational design and development. [58]

Limitations

There are several limitations that should be acknowledged while interpreting the study results. First, our participants consist of stakeholders representing providers more than patients and families, which may have limited the feedback reported. Second, our research was conducted in a controlled setting and did not involve any real-world testing and observations. As such, the practical implications of our study remain limited to self-reported and perceived usability, feasibility and implementation with a limited user experience. Further research in real-world scenarios is required to evaluate the effectiveness and feasibility of chatbot in addressing social needs. Lastly, our research focused primarily on qualitative data, thus lacking quantitative information to assess the chatbot performance with a longitudinal observation. Future studies will aim to collect quantitative measures, such as user logs, response accuracy and user satisfaction rates, to provide a more comprehensive evaluation of the chatbot in addressing social needs.

Conclusion

The study reported iterative design and evaluation of a chatbot for social needs screening and resource identification, designed to scale screening and resource sharing for low-resource communities and disadvantaged neighborhoods. Further, it may augment health centers services, delegating low risk tasks (such as resource finding and sharing) to chatbot to scale the services provided. The DAPHNE chatbot has garnered largely favorable responses, providing initial evidence for its practicality and viability. Crucial factors in designing chatbots for social needs involve fostering user confidence, ensuring the precision of resources, and tackling accessibility obstacles. Future studies should investigate the efficacy, cost-efficiency, and expandability of chatbot initiatives, the opportunities provided by conversational AI technologies, as well as possible collaborations with other established digital health interventions.

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Conflict of Interest

None disclosed.

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