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Development of a chatbot for depression: adolescent perceptions and recommendations

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Background: Chatbots are a relatively new technology that has shown promising outcomes for mental health symptoms in adults; however, few studies have been done with adolescents or reported adolescent user experiences and recommendations for chatbot development. **Methods:** Twenty three participants ages 13–18 (M_{age} = 14.96) engaged in user testing of a chatbot developed to psychoeducate adolescents on depression, teach behavioral activation, and change negative thoughts. Thematic analysis was conducted of participants' responses to user experience questions, impressions, and recommendations. **Results:** Over half (56.5%) of the sample completed the full intervention and provided user experience feedback online. The average NPS score was 6.04 (*SD* = 2.18), and 64.3% (*n* = 9) said they would use the chatbot in the future. Of all user experience responses, 54.5% were positive. The most common impressions were related to symptom improvement (61.1%) and availability (52.8%) The most frequent recommendations were related to solving technical problems (66%). **Conclusions:** Chatbots for mental health are acceptable to some adolescents, a population that tends to be reluctant to engage with traditional mental health services. Most participants reported positive experiences with the chatbot, believing that it could help with symptom improvement and is highly available. Adolescents highlighted some technical and stylistic problems that developers should consider. More pilot and user testing is needed to develop mental health chatbots that are appealing and relevant to adolescents.

Key practitioner message

- Chatbots are a relatively new technology; however, few studies have been done with adolescents.
- Most adolescents perceived the chatbot positively and believed that it could help with symptom improvement and that it is highly available.
- Chatbots for mental health are acceptable to some adolescents, a population that tends to be reluctant to engage with traditional mental health services.

Keywords: Chatbots; depression; adolescent; behavioral activation; digital intervention; conversational agent

Introduction

In a study conducted in 2021, 37.1% of adolescents surveyed experienced poor mental health during the pandemic, and 31.1% reported experiencing poor mental health symptoms in the past month Jones et al., 2022. Additionally, many adolescents do not seek mental health services because they desire to cope with problems independently and are doubtful about the effectiveness of professional services Radez et al., 2021. These challenges should serve as a call for researchers to develop new treatments for adolescent depression. Chatbots are a relatively new technology that has shown promising outcomes for mental health symptoms in adults (Lim, Shiau, Cheng, & Lau, 2022); however, few studies have been done with adolescents.

The few chatbots designed explicitly for adolescent mental health challenges target resilience, weight management, body image, and support with adolescent-related problems such as bullying. Holt-Quick et al. (2020) developed a chatbot to increase resilience in youth using a CBT framework. Stephens, Joerin, Rauws, and Werk (2019) showed that a chatbot for weight management challenges and prediabetes symptoms in adolescents helped them progress toward their goals and was perceived as useful 96% of the time. Beilharz, Sukunesan, Rossell, Kulkarni, and Sharp (2021) showed that KIT, a positive body image chatbot, was found to be useful and provided information on how to improve its usability of the chatbot. Bae Brandtzæg et al. (2021) designed a chatbot to support young people with sex, school, bullying, feelings, love, and divorce issues. They found that users perceived social support from the chatbot and that it was easier to self-disclose to a chatbot than to a human because chatbots provide anonymity and privacy. Due to the nature of chatbots, receiving feedback from users will help hone their development to be more customizable and engaging, which could lead to improved efficacy, as suggested by Klos et al. (2021).

Since adolescents tend to use novel technologies, they may have high expectations about the design and quality of digital interventions. Those developing digital interventions for adolescents must consider how they perceive them and their recommendations for development, as Grové (2021). Merry et al. (2020) also suggest involving users in the design and development process as was done with the digital intervention, HABITs ecosystem. The current study aims to understand (a) the user

experience of adolescents with a chatbot for depression, (b) adolescents' perceptions of mental health chatbots, and (c) adolescents' recommendations for future chatbot development.

Methods

The participants of this study were 13- to 18-year-olds in the United States recruited through their parents. The materials in this study included a chatbot (Beth Bot) created by the research team to provide psychoeducation on depression and teach basic coping skills. Beth Bot is a text-based chatbot delivered via Facebook Messenger and includes six modules: introduction, four CBT-based intervention modules, and a conclusion module. The chatbot was rule-based, so the order of messages and the chatbot's responses were not dependent on the users' comments. The script of the chatbot also included Likert scale, open-ended, and net promoter score (NPS) questions to assess user experience. The net promoter score question asked if participants would recommend the chatbot, using a scale from 0 (would not recommend) to 10 (would strongly recommend). Open-ended questions about adolescents' perceptions and user experience were analyzed using thematic analysis following the procedure of Braun and Clarke (2006).

Participants were recruited for this study through their parents, who were needed to sign a consent form. Recruitment was conducted through contacts of the authors' lab and through Facebook ads. After parents provided consent, adolescents completed assent and began the chatbot intervention through an anonymized Facebook Messanger portal on a webpage. First, participants completed the six intervention modules and then a series of user experience questions. The study was designed to be completed in one session, and if participants were idle on the webpage or closed it, they were discontinued from the study. The entire study took participants 30 minutes or less to complete.

Results

Participants ($N = 23$) were on average 14.96 ($SD = 1.49$) years old, 54.5% identified as male, 40.9% as female, and 9% declined to state a gender. The majority of participants reported living in California (69.6%).

Of the participants who started to use the chatbot, 56.5% ($n = 13$) completed the entire intervention and responded to the user experience questions. To assess user experience, the NPS and responses were analyzed. Thirteen participants responded to the NPS question. The average NPS score was 6.04 ($SD = 2.18$), and 64.3% ($n = 9$) said they would use the chatbot in the future. Across participants, 22 responses explained their NPS scores (some participants provided multiple comments). These responses were organized into positive, neutral, and negative valence, and 54.5% of the responses were identified as positive.

Across participants, 36 comments were made on user perceptions of mental health chatbots. The most common themes identified were symptom improvement (61.1%) and availability (52.8%). Themes mentioned by fewer users also included the following: chatbots may be helpful, good for adolescents, and offer privacy.

Three broad recommendations for future chatbot development were stated by the participants. They suggested improving: technical issues, personalization, and content issues. 66% of the sample reported technical problems, and typing time issues ($n = 6$) were the most frequent sub-theme identified. Emojis ($n = 4$) were the most frequent sub-theme identified within content issues. See Table 1 for a description of themes identified across qualitative responses.

Discussion

About half of the participants (56%) completed the study, which is congruent with many digital intervention studies Pratap et al., 2020. However, it is lower than in previous chatbot studies with adults (Dosovitsky, Kim, & Bunge, 2021). Since recruitment was done through the parents, it is hard to make strong conclusions about participants' motives to complete the study or drop out. For those that dropped out, it is possible that they were not interested in a chatbot for mental health or did not relate to problems with depression. Note, Radez et al. (2021) reported that young people were less likely to seek help if they believed it was their parents' choice. Thus, future studies should aim to recruit adolescent participants directly. Developers should keep these potential reasons for dropout in mind to prevent them, and researchers should advocate for institutional review boards to provide waivers of parental consent for usability studies of micro-interventions that have less risk than full-length treatment studies.

It is noteworthy that 54.5% of participants who answered user experience questions had a positive view of the chatbot which shows that a portion of adolescents are interested in chatbot interventions. This finding is promising given that many adolescents do not seek mental health services due to a desire to cope with problems on their own (Radez et al., 2021). Interestingly, most adolescents consistently reported that chatbots could help users improve symptoms and offer someone to talk to. Given adolescents' concerns about the efficacy of mental health resources (Radez et al., 2021), it is noteworthy that adolescents reported that chatbots could improve their symptoms.

Recommendations for future development include three major topics: technical issues, the need for personalization, and content issues. Technical issues were the most frequently reported theme, and typing time was the most common technical problem. The chatbot was programmed to deliver messages with a delay to emulate someone thinking and typing. Some users reported that messages were sent too fast, while others said it was too slow. More user testing is necessary to determine the optimum latency between messages.

Adolescents' recommendation of personalizing the chatbot may be a reaction to the scripted bot used in this study. Additionally, several adolescents reported that a human could give better advice than the chatbot provided. Given that Zhu and colleagues (2022) identified that personalized chatbots predicted user satisfaction and intention to continue using the chatbot, chatbots for adolescents should aim for high levels of personalization. Personalization could be increased by using artificial intelligence and natural language processing techniques. This would likely necessitate interdisciplinary collaboration between psychologists and machine learning professionals.

Several adolescents reported that the chatbot had issues with content, such as not being generationally attuned through emojis, periods, and multiple-choice questions. The chatbot in the current study was

Table 1. Summary of themes identified in qualitative responses

Questions and Themes	Definitions	Example	Frequency
Q.1 User Experience			22
Positive	Having a positive or optimistic view of the utility of the chatbot	"My friends have trouble explaining things to people so a bot would secure them to know their problems are safe"	12 (54.5%)
Neutral/Ambiguous	Having a neutral view of the utility of the chatbot	"Might be helpful, but the bots abilities are very limited"	3 (13.6%)
Negative	Having a negative or pessimistic view about the utility of the chatbot	"I would believe talking to a counselor or an adult could help them in a better way."	7 (31.8%)
Q. 2 Impressions			36
Symptom Improvement	The chatbot could help people improve their mental health symptoms	"Teach you how to change your mood"	22 (61.1%)
Availability	The chatbot is available to talk with the user.	"Help teens that are struggling with depression but don't want to (or feel like they can't) reach out for help"	19 (52.8%)
Q. 3 Future Development			27
Technical Issues	Users had technical problems related to the chatbot misunderstanding them.	"Sometimes I put the answer to the question in the sentence and then it didn't recognize it"	10 (66.0%)
Personalization	Users felt the chatbot was not responding in a personalized way or was ignoring specific details the user shared.	"The responses could be more tailored to the person"	9 (60.0%)
Content Issues	The content of the chatbot's script was awkward, not appropriate, or not generationally attuned to adolescents.	"It felt a little repetitive. Like everything discussed could be summed up by changing your mood and going and doing something"	8 (53.0%)

developed with recommendations from adolescents, who suggested the use of emojis; however, the chatbot was deployed about two years later, and emojis were then negatively perceived. Past research has found that adolescents were interested in having a chatbot use adolescent slang and emojis (Grové, 2021). To better understand adolescents' perceptions of such features, conducting focus groups and considering that adolescents' preferences change rapidly would be helpful. Developers should conduct short and frequent user experience trials to make small but timely changes to chatbots targeting adolescents. Making quick changes based on recommendations may be easier with chatbots compared to other digital interventions increasing the opportunity for cultural alignment (Merry et al., 2020).

Limitations

The sample size of the current study was small. While this is congruent with user experience studies, more studies are needed to obtain more generalizable conclusions. The sample mainly included adolescents from California, so the findings may not translate to other states or countries. Furthermore, about half of the participants engaged with user experience questions (56.5%), so the impressions of those who dropped out are unknown. One possible explanation for this is the chatbot intervention was designed to be completed in one session to avoid collecting adolescents' information, so users were not able to return to the session later. Merry et al. (2020) highlight the "digital divide," which states that young people without access to technology will have difficulty accessing chatbot interventions, while they may have the most to gain from a free psychoeducational program such as this one. Future studies should make a concerted effort to include socioeconomically disadvantaged populations in developing and implementing digital tools.

Conclusions

Chatbots for mental health are acceptable to a considerable portion of adolescents, a population that tends to be reluctant to engage with traditional mental health services. Overall, the current study shows that some adolescents are interested in chatbot interventions for mental health. A majority of those that completed perceived the chatbot in the current study as positive and stated that it could improve their symptoms and appreciated its availability. They provided recommendations for improving technical issues, having a more personalized chatbot, and adjusting the content to their generational preferences. The research on adolescent perceptions of chatbots for mental health is still in the early stages. Future researchers should first aim to develop acceptable chatbots, increase their usability, and then assess their efficacy.

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Ethical information

The following study was approved by the institutional review board at Palo Alto University (Assurance Number: FWA00010885).

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