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The role of chatbots in paediatric chronic disease management: Trends, findings, and future recommendations

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Abstract

Background: Chronic diseases in children, such as chronic kidney disease (CKD), diabetes, and asthma require complex long-term management because they can affect the quality of life physically, psychologically, socially, and educationally. One of the new innovations in supporting the management of chronic diseases in children is the use of chatbots that play a role in education, health monitoring, and psychological support.
Purpose: To review the literature on the effectiveness of chatbots in supporting self-care in children with chronic diseases.
Method: This literature review study examined the effectiveness of chatbots in supporting self-care in children with chronic diseases. The articles used were from ProQuest, Scopus, ScienceDirect, and Google Scholar. Inclusion criteria included publications from 2014-2024 that focused on children with chronic diseases. The search keywords used were "conversational agent", "chronic disease management", and "children". The search for articles used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and obtained 6 articles for review.
Results: Analysis of the selected articles suggests that chatbots have the potential to provide easily accessible educational resources, assist in regular monitoring of children's health, and provide emotional support to children in managing chronic diseases. However, there are several challenges, such as limitations in chatbot personalization and the importance of family involvement in chatbot use.
Conclusion: Chatbots have great potential to support chronic disease management in children, although further development is needed on the aspects of personalization and data privacy to make their use more effective and safe for children.
Suggestion: Long-term research is needed to assess the lasting impact of chatbots on children's health outcomes, including mental development and quality of life. Developing more personalized and responsive chatbots and exploring their integration with other technologies such as wearables are also interesting areas for further exploration.

Keywords: Chatbot; Children; Chronic Disease Management.

INTRODUCTION

Chronic diseases in children, such as chronic kidney disease (CKD), diabetes, and asthma require complex, long-term management that significantly impacts their quality of life. These conditions can affect children's physical, psychological, and social health as well as their educational development, requiring a comprehensive and consistent approach to care (Fibrianto, Lestari, Kesuma, Damayanti, Fitriana, & Rismarini, 2023). Among chronic diseases, CKD in children is a serious condition with a global

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prevalence ranging from 15-74.7 cases per million children (Amanullah, Malik, & Zaidi, 2022). National data on the number of children with CKD in Indonesia is not yet available. However, based on records from the Department of Pediatrics at Cipto Mangunkusumo National Hospital in Jakarta, there were 382 children diagnosed with CKD in 2006-2007 (Pardede & Chunnaedy, 2016). Children with advanced CKD require renal replacement therapy, such as hemodialysis or kidney transplantation, which poses various challenges in long-term care.

Managing chronic diseases in children, including CKD, requires consistent care, including special dietary restrictions, fluid management, and close health monitoring. In addition, children with chronic diseases often face significant emotional and psychological challenges, such as the stress of undergoing routine care, uncertainty about their health condition, and substantial lifestyle changes (Aier, Pais, & Raman, 2021; Baghdadi & Alsaiady, 2024; Tanjung, Agustini, & Wanda, 2023). Parents also experience stress in ensuring their child's adherence to treatment, maintaining proper nutrition, and supporting their child's mental health. In this context, innovative approaches are needed to support children's self-care skills and help parents manage their child's condition effectively.

Various innovations have been developed to support the management of chronic diseases in children, along with the advancement of digital technology in healthcare. One such innovation is the use of chatbots, computer programs designed to automatically simulate human conversation through text or voice using artificial intelligence. In the context of healthcare, chatbots can provide responsive and personalized interactions to help patients and families monitor health conditions, provide education about care, and provide emotional support, as well as offering benefits in terms of efficiency and cost-effectiveness (Haque, Chowdhury, & Soliman, 2023; Sun & Zhou, 2023). Teknologi chatbot memungkinkan pasien dan keluarga memiliki akses lebih besar terhadap perawatan di rumah, sehingga mengurangi ketergantungan pada fasilitas layanan kesehatan yang mungkin sulit dijangkau.

In the context of CKD, chatbots can serve as medication reminders, provide information on proper diet, and assist in remote health monitoring (Islam, Hasan, & Hasan, 2023). For children with diabetes or asthma, chatbots can also send reminders to take medication, provide information on self-management, and facilitate tracking of symptoms or triggers that may impact health (Kowatsch, Schachner, Harperink, Barata, Dittler, Xiao, & Möller, 2021; Vertsberger, Naor, & Winsberg, 2022). Thus, chatbots can serve as flexible support tools for managing various chronic diseases, helping children become more independent in managing their health conditions.

Chatbots can serve not only for education and monitoring, but also have the potential to offer psychosocial support. Children and families managing chronic illness often experience stress and anxiety, and chatbots can provide emotional support through words of encouragement, relaxation techniques, or advice on how to cope with the stress associated with chronic illness for children and their parents (Kim, Hwang, Oh, Kim, & Kim, 2023). With these features, the chatbot serves as a physical and psychological health companion tool that can improve the quality of life of children with chronic diseases.

Although chatbots have significant potential in supporting chronic disease management, this technology still faces several challenges. Some of the limitations include optimizing features for conditions that require intensive monitoring, limited access to technology, and the need for digital literacy among users (Chowdhury, Haque, & Soliman, 2023; Kowatsch et al., 2021). Operating a chatbot can also be challenging for children, so the role of parents or caregivers is very important in guiding its use. Additionally, health data security and privacy are critical aspects that must be maintained to ensure user trust (Elmaoğlu, Coşkun, & Yüzer Alsaç, 2024).

This literature review will explore trends in the use of chatbots to support chronic disease management in children. It will also analyze how chatbots can assist children and their families in self-care, education, condition monitoring, and medication reminders. By assessing the effectiveness and challenges of chatbot applications in improving children's quality of life.

RESEACH METHOD

A systematic literature review to obtain relevant articles on the use of chatbots in chronic disease management for children. The search for articles used the Preferred Reporting Items for Systematic Reviews

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and Meta-Analyses (PRISMA) guidelines. The search used ProQuest, Scopus, ScienceDirect, and Google Scholar databases. The main keywords used were "conversational agents", "chronic disease management", and "children", which were combined using Boolean operations (AND, OR) to generate relevant search results.

Inclusion criteria were published within the last 10 years (2014-2024), original research with quantitative, qualitative, or mixed methods research design, focused on pediatric populations with chronic diseases, and written in English. Articles that discussed chatbots only in a technical context without direct relevance to pediatric health or that focused on adult populations were excluded from this review.

The article selection process was carried out through several stages. First, an initial search was conducted to identify articles based on predetermined keywords and databases. Second, identified articles were screened based on title and abstract to ensure initial relevance to the topic discussed. Articles that passed the initial screening were fully assessed to ensure compliance with the inclusion and exclusion criteria. After this process, six articles were selected that were considered representative of chatbots in supporting chronic disease management in children related to education, monitoring, and emotional support.

Once the articles were selected, relevant data were extracted for qualitative analysis. Each article was analyzed based on the aspects discussed, such as study objectives, research design, key findings related to the use of chatbots, limitations, and recommendations identified in the study. This analysis aimed to comprehensively understand the trends, findings, and challenges in the application of chatbots to support chronic disease management in children.

RESEARCH RESULTS

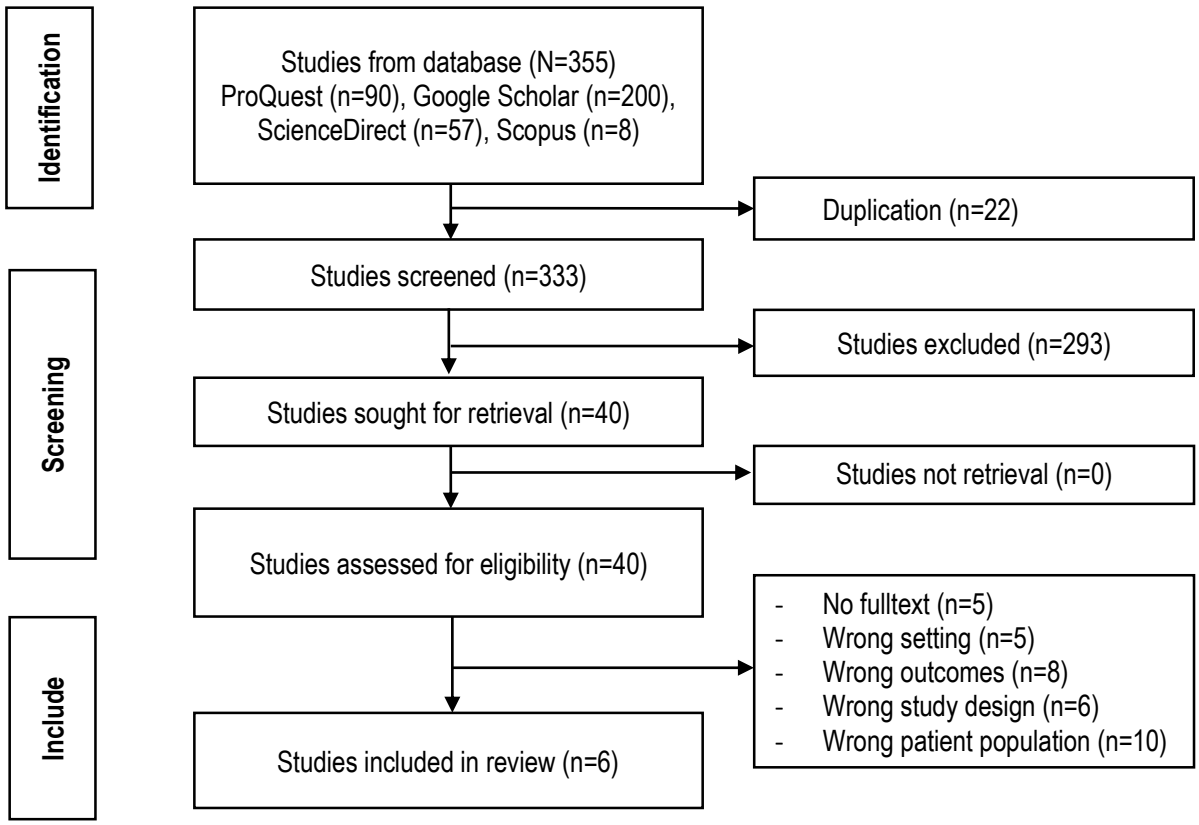


Figure PRISMA Flow Diagram

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Article Data Mapping Results Table

(Authors)(Country)	Purpose	Method	Results
(Kowatsch et al., 2021) (Switzerland).	To determine the role of conversational agents, specifically the MAX chatbot, in facilitating collaboration between healthcare providers, patients, and family members in managing chronic diseases, especially asthma in children. In addition, this study assesses the effectiveness, acceptability, and outcomes of using the MAX chatbot in everyday life for children and their parents.	A single-group feasibility study was conducted in children aged 10–15 years with asthma, their family members, and healthcare providers. The sample size used was 99 family members of patients. The intervention provided using a digital conversational agent MAX (Mobile Coach for Asthma Patients) provided individual coaching sessions, including inhalation techniques and asthma knowledge. The intervention also included other components, such as a mobile application.	Conversational agents can be a positive and engaging tool to increase patient engagement in disease management.
(Kadariya et al., 2019) (USA).	To develop and evaluate kBot, a chatbot designed to help asthma patients, particularly children, better manage their condition by monitoring medication adherence and identifying environmental triggers.	The study involved interacting with the chatbot through simulated patient scenarios. The sample used was children aged 8-15 years who suffered from asthma. The initial evaluation sample consisted of 16 respondents, including eight domain experts (clinicians), and eight non-domain experts (researchers). kBot is a chatbot application that functions as a personal assistant for asthma management. The application operates on the Android platform and interacts with the user using a conversational interface.	kBot achieved a technology acceptance score of over eight on an 11-point Likert scale and an average System Usability Score (SUS) above 80, indicating good acceptance by evaluators.

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(Authors)(Country)	Purpose	Method	Results
(Boggiss et al., 2023) (New Zealand).	To evaluate the acceptability and potential clinical utility of the COMPASS chatbot application designed for adolescents with Type 1 Diabetes (T1D).	A qualitative study using focus group discussions (FGDs) and face-to-face interviews to explore the acceptability and potential clinical benefits of the COMPASS chatbot application. The sample used was adolescents aged 12-16 years with Type 1 Diabetes (19 respondents) and healthcare providers who manage diabetes (11 respondents). The COMPASS chatbot is designed to provide a self-compassion-based coping tool for adolescents with T1D.	The COMPASS chatbot has the potential to be well-received by adolescents and healthcare providers. The study identified desired features, such as personalized content and user-to-user support, that could increase user engagement with the app.
(Kim et al., 2023) (South Korea).	To develop an informative and empathetic chatbot for childhood cancer survivors to help them cope with the psychosocial challenges they face during and after cancer treatment.	This development study aims to develop a chatbot using qualitative data from childhood cancer survivors. The study also involves a comparative analysis of instructions to generate optimal responses from the chatbot. The sample size was not specified, but data was collected from survivor quotes taken from academic articles and social media. A Large Language Model (LLM) such as OpenAI ChatGPT to generate empathetic responses. In addition, domain adaptive training techniques were applied to ensure the model provides responses that are appropriate to the needs of childhood cancer survivors.	The developed chatbot provides relevant information and empathetic responses to childhood cancer survivors, helping them cope with the psychosocial challenges they face.

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(Authors)(Country)	Purpose	Method	Results
(Gyamlani, 2023) (USA).	To develop and evaluate a digital application called Starfly, designed to support the mental health of children with chronic illness through positive, stigma-free social interactions.	The app was tested on a group of children with chronic illnesses and focused on collecting data on social interactions and their impact on mental health. The sample used was children with chronic health conditions and children with disabilities. The sample size was not explicitly specified in the given context. Starfly is an app that uses AI and large language model (LLM) technology to detect patterns and changes in children's communication. The app provides a safe space for children to interact through art, text, and video chat.	Expected outcomes include improving the mental wellbeing of children using the Starfly app and collecting data that can provide insights into users' mental health outcomes.
(Rhee et al., 2014) (USA).	To develop and evaluate the feasibility and acceptability of an asthma self-management tool (mASMAA) designed to facilitate symptom monitoring, medication adherence, and partnership between adolescents and parents in asthma management.	A feasibility study involving scheduled and unscheduled interactions between adolescents and mASMAA, with feedback gathered through focus groups after the pilot period. The sample used was adolescents aged 12-17 years with asthma and their parents. The sample consisted of 15 adolescent-parent pairs who participated in a two-week pilot. The mASMAA system is a mobile asthma management tool that uses natural language understanding technology. The system allows adolescents to communicate using informal English and send text messages about their asthma condition.	Use of mASMAA increased adolescent awareness of asthma symptoms and triggers, encouraged medication adherence, and strengthened the partnership between adolescents and parents. Response rates for daily text messages were 81-97%, with an average of 19 self-initiated messages per individual.

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DISCUSSION

Based on the analysis of the six selected articles, the main themes that emerged regarding the use of chatbots in chronic disease management for children were education and provision of medical information, monitoring of health conditions, and psychological and emotional support.

Chatbots provide general knowledge about the disease that is easily accessible to children and their families. Chatbots act as a bridge to help children with chronic conditions and their families understand the disease and its management (Kowatsch et al., 2021). Chatbots also offer ongoing educational guidance, which improves children and families' understanding of chronic disease management. Meanwhile, the knot chatbot used by asthma patients helps them recognize symptoms and determine the right treatment steps, thereby increasing confidence in self-care (Kadariya et al., 2019).

Chatbots also serve as health monitoring tools, helping children with chronic illnesses by tracking daily symptoms. In a study (Rhee, Allen, Mammen, & Swift, 2014), the mASMAA chatbot supported children with asthma by tracking daily symptoms, reminding them about medication schedules, and sending data to healthcare providers for remote monitoring. During the Covid-19 pandemic, a self-compassion-based chatbot was used to help adolescents with type 1 diabetes maintain their care routines, even in challenging situations (Boggiss et al., 2023).

Some chatbots are also designed to provide emotional support to children with chronic illnesses. One study also developed a chatbot for pediatric cancer survivors that created a space for patients to share their feelings and receive emotional support that aided their recovery (Kim et al., 2023). Additionally, other studies have shown that peer-support-based chatbots can improve mental health in children with chronic illnesses, reduce loneliness, and provide a sense of community through empathetic interactions (Gyamlani, 2023).

Chatbots have shown positive impacts in helping children manage chronic illnesses, particularly in education, health monitoring, and emotional support. Chatbots facilitate access to medical information, help children become more independent, and provide psychological support. Several studies support the effectiveness of chatbots in providing easily accessible medical information and helping children understand and manage their conditions (Kadariya et al., 2019; Kowatsch et al., 2021). Studies have shown that chatbots play a role in health monitoring, such as medication reminders and symptom tracking (Boggiss et al., 2023; Rhee et al., 2014). Psychological support offered by chatbots has been shown to reduce anxiety in children and adolescents with chronic illnesses (Gyamlani, 2023; Kim et al., 2023).

Chatbots have significant potential to support health management for children with chronic conditions, but several technical and methodological challenges hinder their implementation and effectiveness. The main limitation is the lack of personalization, as chatbots often fail to fully address the unique needs of each child, resulting in generic rather than tailored responses. This issue is highlighted in studies that underscore the importance of personalization in psychological support (Kim et al., 2023; Rhee et al., 2014).

In addition, long-term use of chatbots is limited by user concerns about their effectiveness as a source of emotional support (Kowatsch et al., 2021). Accessibility is also limited, with implementations restricted to specific platforms and lack of integration with hospital information systems, which hinders comprehensive clinical evaluation (Kadariya et al., 2019; Kowatsch et al., 2021). Data security and privacy are important considerations, especially for child users who require special protection (Gyamlani, 2023). Finally, small sample sizes and limited data collection methods, including limited participant interaction with the chatbot, may reduce the external validity of the study findings and limit understanding of chatbot effectiveness in a broader context (Boggiss et al., 2023).

The use of chatbots in supporting chronic disease management in children holds significant potential in nursing practice, especially in enhancing the role of nurses in providing health education, monitoring, and psychological support to children and their families. In this context, nurses can use chatbots as an additional tool to deliver health information and guide adolescents in understanding their condition, as identified in several studies (Kadariya et al., 2019; Kowatsch et al., 2021). Additionally, nurses need to equip families with knowledge on how to use chatbots

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and ensure data security, mainly because the users of chatbots are children who require strict privacy protection (Baghdadi & Alsaiady, 2024; Gyamlani, 2023). Through this approach, chatbots can serve as a complementary service to that provided by nurses, strengthening the effectiveness of educational and psychological support beyond direct interactions.

Chatbots offer a variety of benefits, but their implementation faces challenges that must be overcome. One of the strengths of chatbots is their ability to provide information quickly and efficiently, as well as remind children to adhere to their medication or therapy schedules, as shown in a study on asthma monitoring (Kadariya et al., 2019; Rhee et al., 2014). On the other hand, the lack of personalization in chatbots poses challenges, leading to responses that tend to be generic and less in-depth, thereby reducing the effectiveness of the psychological support provided (Boggiss et al., 2023; Haque et al., 2023). Additionally, family involvement in using chatbots remains a challenge, even though family support is crucial in managing chronic diseases in children (Aier et al., 2022; Tanjung et al., 2023). Trust in chatbots, particularly regarding emotional support, also becomes challenging as children may find it more difficult to open up to a chatbot than a human (Gyamlani, 2023; Kim et al., 2023). Therefore, optimising the use of chatbots requires special attention to personalisation and family involvement.

Given these challenges, future chatbot development may focus on enhancing artificial intelligence (AI) capabilities to make chatbots more responsive and able to adapt interactions to each child's unique needs (Islam et al., 2023; Sun & Zhou, 2023). Through more sophisticated AI integration, chatbots are expected to provide more personalized support. At the same time, increasing the accessibility of chatbots in developing countries can expand their impact to children who need support for chronic disease management (Bin Sawad, Narayan, Alnefaie, Maqbool, Mckie, Smith, & Kocaballi, 2022). Furthermore, future development could include integration with wearable devices for real-time health monitoring and gamification elements to make interactions with chatbots more engaging for children (Chang, Chang, & Chang, 2024; Chowdhury et al., 2023). Through this development direction, chatbots can increasingly play an important role as partners in helping children manage their chronic conditions independently.

CONCLUSION

The use of chatbots in chronic disease management for children has become a growing trend, with key benefits in health education, condition monitoring, and emotional support. Chatbots have been shown to be effective in helping children become more independent in managing their disease, facilitating access to relevant medical information, and providing psychological support that can reduce anxiety. However, certain limitations need to be addressed to improve their effectiveness, such as lack of personalization and family involvement.

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SUGGESTION

Further research is needed to evaluate the effectiveness of chatbots for other chronic illnesses, such as chronic kidney disease, to understand how well this technology can adapt to the specific needs of each illness. Additionally, long-term studies are necessary to assess the sustained impact of chatbots on children's health outcomes, including mental development and quality of life. Developing more personalised and responsive chatbots and exploring their integration with other technologies like wearable devices also represents an intriguing area for further exploration.

In nursing practice, nurses and other healthcare professionals are encouraged to use chatbots as a supportive tool to help children with chronic illnesses. Nurses can introduce chatbots to children and their families and guide them on how to use them safely and effectively. Nurses should also continuously monitor the child's interactions with the chatbot, ensure the child is receiving accurate information, and provide additional support when the chatbot is unable to meet the child's specific emotional or informational needs. Through this approach, chatbots can effectively complement chronic illness management in children, increasing engagement and understanding in managing their health conditions.

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