Review Paper

Artificial Intelligence-powered Chatbot Intervention for Maternal Health: A Systematic Review Study

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ABSTRACT

Background: Optimal maternal care requires timely access to accurate information. Recent technological advancements have led to the development of chatbots that provide essential information to women, empowering informed decision-making and enhancing healthcare experiences. These tools can significantly improve maternal health outcomes and support child well-being. However, research in this area is limited, highlighting the need for further exploration. This systematic review analyzed the existing literature on using chatbots in maternal care.

Methods: This systematic review followed the PRISMA-ScR guidelines to identify studies focused on using chatbots in maternal care. We searched PubMed, Web of Science, Scopus, and Google Scholar without limitations on time or geography to locate relevant studies. Data were collected using a standardized extraction form, and the results were presented in tables.

Results: This study reviewed 10 articles out of 245 retrieved. Most of the research was conducted in Brazil and Singapore in 2024, utilizing a mixed-methods approach. Most of them designed the chatbot as a mobile application. The average age of the participants was 32.56 years, and the total follow-up period across the studies was 33 months. The primary objective was to enhance the mental health of pregnant women both during pregnancy and after childbirth. The chatbots provided timely health information on prenatal and postnatal care, dietary guidelines, and mental health support. Further research is needed to validate these findings and to advance the development of chatbot technology within healthcare.

Conclusion: This systematic review suggests that chatbots can positively impact maternal health by providing essential support to pregnant women and new mothers. However, more studies are needed to confirm these benefits and to find the best ways to use this technology in healthcare.

Keywords: Maternal health, Artificial intelligence (AI), Chatbot, systematic review

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Introduction

Maternal health is a cornerstone of societal development [1]. Ensuring access to quality maternal care throughout pregnancy, childbirth, and the postpartum period is crucial for the well-being of mothers and their children. It empowers women to make informed decisions regarding their health, leading to improved outcomes for both themselves and their offspring [2]. However, significant disparities exist globally in access to and the quality of maternal healthcare services, resulting in unacceptably high rates of maternal mortality and morbidity [3]. In response to these challenges, technological advancements, particularly in artificial intelligence (AI), offer promising solutions [4]. AI-powered tools have the potential to revolutionize maternal care by enhancing patient monitoring, improving access to information and support, and enhancing the accuracy of diagnoses [5, 6]. One such promising technology is automated chat systems, commonly known as intelligent conversation chatbots [5]. AI technologies are evolving rapidly, and AI-powered chatbots are leading the way with their remarkable potential [7]. A chatbot is a sophisticated software application designed to simulate human conversation [8]. These innovative software applications engage users in dynamic conversations, providing personalized information and support through text or voice interactions [9]. It delivers prompt responses and assists with a range of tasks, making it an essential tool in customer service settings. Its ability to enhance efficiency and improve customer interactions contributes to its widespread adoption in healthcare [10]. By leveraging advanced algorithms, chatbots can create seamless and engaging user experiences, facilitating access to critical information and improving communication between patients and healthcare providers [11]. These chatbots can transform the learning experience through tailored interactions and significantly enhance support within the healthcare sector [12]. In the ever-evolving healthcare landscape, the integration of chatbot technology into maternal care has the potential to improve patient support and outcomes significantly [13]. This innovative approach equips woman with essential information, fostering informed decision-making and enhancing their overall healthcare experience [13, 14]. Chatbots generally offer more reliable responses to healthcare inquiries compared to traditional healthcare resources [15]. The integration of chatbots in healthcare organizations enhances efficiency and reduces the workload on professionals while easing pressure on the system. For patients, chatbots facilitate self-management, improving adherence to treatment and overall quality of life [15, 16].

Numerous original studies have investigated the effectiveness of chatbots in educating mothers before and after childbirth to enhance maternal care. These studies indicate that chatbots have the potential to significantly improve maternal health, child well-being, and parenting knowledge [16–19]. However, a thorough review of the existing literature in this area appears to be lacking. Systematic reviews are vital as they provide a comprehensive summary of all available primary research on specific clinical inquiries [20]. This study aimed to explore the potential applications of chatbot technology in improving maternal health outcomes. By conducting an extensive systematic review of the current literature, we identified studies demonstrating the impact of chatbots on maternal healthcare. Our objective was to synthesize the existing evidence, pinpoint knowledge gaps, and inform future research initiatives. This study aspires to deepen our understanding of how chatbot technology can be effectively integrated into maternal care, thereby enhancing patient outcomes and empowering women to make informed decisions regarding their health.

Methods

This systematic review aimed to identify studies on chatbot interventions for maternal health. This report was written based on the preferred reporting items for systematic reviews and meta-analyses (PRISMA) 2020 checklist [21].

Search strategy

We searched three major databases—PubMed, Web of Science, and Scopus—supplemented by Google Scholar. The search was conducted from October 20 to October 28, 2024, as detailed in Table 1. No limitations were imposed on the publication year or geographical area, and the search was limited to English-language articles. Our initial search identified 245 studies, which we refined to 24 by eliminating duplicates and studies that did not meet our criteria. Ultimately, 10 studies fulfilled our inclusion requirements, underscoring the significant potential of chatbot interventions in improving maternal health (Figure 1).

Selection criteria

Inclusion and exclusion criteria were applied to ensure the inclusion of relevant studies. The following inclusion criteria were established: 1) Publications must originate from peer-reviewed journals, book chapters, dissertations, or conference proceedings. 2) Studies should specifically investigate the chatbot interventions for maternal health.

Table 1. Search strategy

Database	Search Strategy	Results
PubMed	((((((“pregnancy”[Mesh]) OR (“obstetrics”[Title/Abstract])) OR (“gynecology”[Title/Abstract])) OR (“maternal care”[Title/Abstract])) OR (“Pregnancies”[Title/Abstract])) OR (“Gestation”[Title/Abstract])) AND ((“chatbot”[Title/Abstract]) OR (“ChatGPT”[Title/Abstract]))	62
Scopus	((((((“pregnancy”) OR (“obstetrics”)) OR (“gynecology”)) OR (“maternal care”)) OR (“pregnancies”)) OR (“gestation”)) AND ((“chatbot”) OR (“ChatGPT”))	103
Web of Science	(((((TS=(“pregnancy”)) OR TS=(“obstetrics”)) OR TS=(“gynecology”)) OR TS=(“maternal care”)) OR TS=(“Pregnancies”)) OR TS=(“Gestation”) AND ((TS=(“chatbot”)) OR TS=(“ChatGPT”))	30
Google Scholar	(“chatbot”) AND (“maternal care”)	50

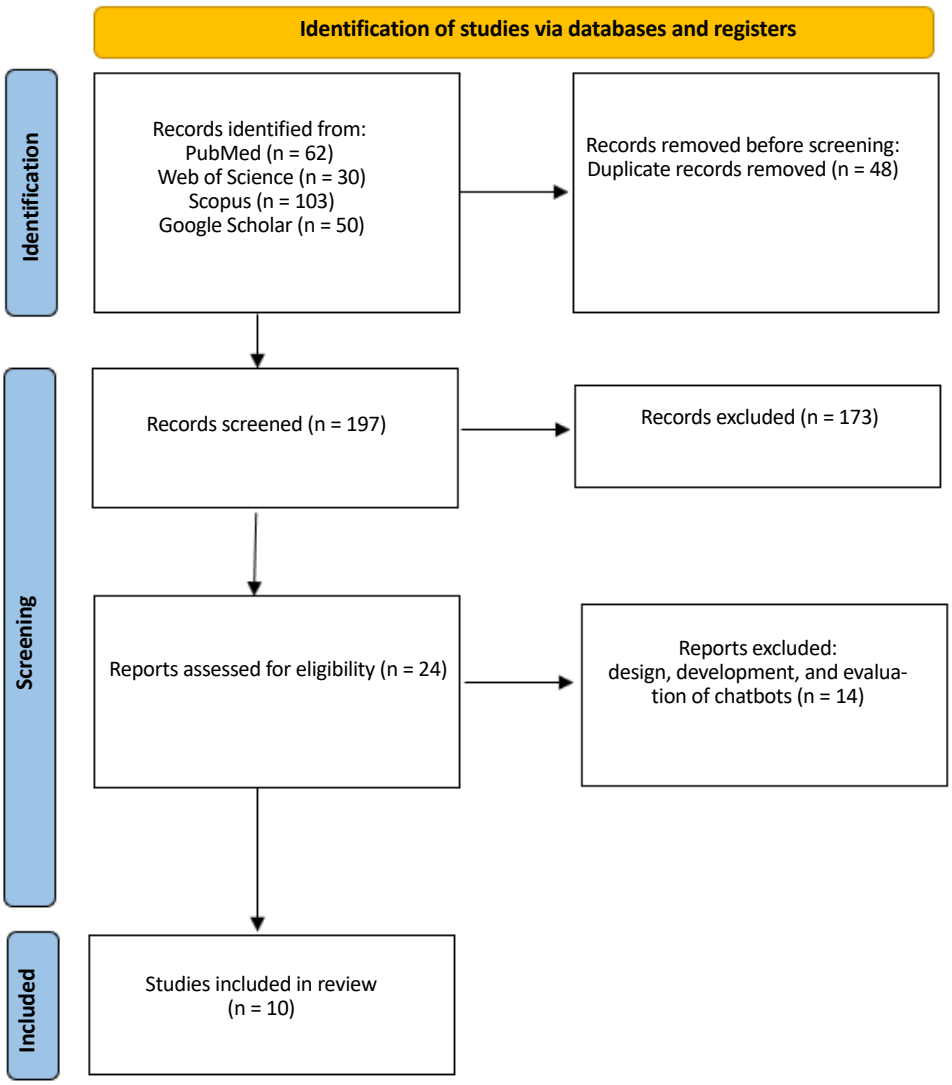

Figure. 1. PRISMA flow diagram detailing the process of study selection

The exclusion criteria were clearly articulated: 1) Non-English publications were not considered. 2) Non-peer-reviewed articles, pre-publication drafts, letters, comments, editorials, case reports, and case studies were excluded from the review. 3) Furthermore, studies that addressed the design, development, and evaluation of chatbots were excluded to ensure a focused scope.

Data extraction

Two reviewers reviewed the titles and abstracts of each study and then examined the full texts to identify those that met the inclusion criteria for our systematic review. In cases where eligibility was uncertain, a third reviewer was consulted for clarification. For data extraction, we employed a custom-designed data extraction form. This form was developed based on the principles of systematic review methodology, ensuring a comprehensive and standardized approach. Data were extracted according to pre-defined criteria, and organized in a structured checklist. This checklist included fields, such as the authors' names, year of publication, country of study, study design, follow-up duration, target population and sample size, mean age, chatbot name and type, study objectives, and main results.

Quality assessment

The quality of the included studies was assessed using the prediction model study risk of bias assessment tool (PROBAST) (Table 2). This assessment tool encompasses four key domains—participant selection, predictors, outcomes, and analysis—and features 20 targeted signaling questions to facilitate a comprehensive evaluation [22]. Two independent reviewers assessed the risk of bias in each study. Any disagreements were resolved through discussion or consultation with a third reviewer.

Data analysis

Data were analyzed using descriptive statistics (frequency and percentage frequency) to summarize the characteristics and findings of these studies. Due to heterogeneity between studies, meta-analysis was not performed.

Results

Study characteristics

Most of the studies were conducted in 2024 (40%) and utilized a mixed-methods approach (60%). In terms of geographical distribution, Brazil, the United Kingdom, and Singapore had the highest number of studies, with two each (20%). In most of these studies, the chatbot was designed as a mobile app (90%); one study used a Telegram bot, and another study featured both a mobile app and a web-based platform. The type of chatbot (text-based, voice-based, multimedia) was not mentioned in the studies reviewed. In three studies, both fathers and mothers participated (30%), while in two studies, gynecologists and midwives joined the mothers (20%). The average age of the study participants was 32.56 years, and the total follow-up duration across the studies was 33 months (Table 3).

Table 2. The quality assessment results

Study	Participants	Predictors	Outcome	Analysis
1	-	+	+	+
2	+	+	+	+
3	-	+	+	+
4	+	+	+	+
5	-	+	+	+
6	-	+	+	+
7	+	+	+	+
8	+	+	+	+
9	+	+	+	+
10	+	+	+	+

Table 3. Summary of the studies included in the systematic review

Author, year [Ref]	Country	Study Design	Follow-up Duration	Number of Participants	Mean age (y)	Name	Type
Bahja et al. 2020 [17]	United Kingdom	Mixed-method	2 weeks	2 midwives, 1 obstetrician, 11 pregnant women	Not Mentioned	Alia	Mobile app
Barreto et al. 2021 [18]	Brazil	Mixed-method	2 months	142 puerperae	25.4	GISSA mother-baby chatbot application (GCBMB)	Mobile app
Chung et al. 2021 [23]	Korea	Mixed-method	11 days	2 men, 13 women	Men=39.00±1.41 Women=34.31±3.95	Dr. Joy	Web- and mobile-based instant messaging application
Montenegro et al. 2022 [24]	Brazil	Mixed-method	1 week	7 physicians, 13 pregnant Women	>30	Maria	Mobile app
Sagstad et al. 2022 [25]	Norway	Observational	4 months	610 dialogues with a total of 2838 questions	Not applicable	Dina	Mobile app
Inkster et al. 2023 [26]	United Kingdom	Mixed-method	8 months	Quantitative phase 51, qualitative phase 10 women	Not Mentioned	Wysa	Mobile app
Chua et al. 2024 [19]	Singapore	RCT	10 months	118 mothers, 118 fathers	32.6±3.98	Parentbot	Mobile app
Chua et al. 2024 [27]	Singapore	Qualitative	5 months	10 mothers, 10 fathers	34.1±5.99	Parentbot	Mobile app
Nguyen et al. 2024 [28]	United States	Mixed-method	2 months	15 treatment group, 14 control group	31.7±4.7	Rosie	Mobile app
Mancinelli et al. 2024 [29]	Italy	Qualitative	6 weeks	5 pregnant women	33.4	Juno	Telegram

The findings were categorized into two primary areas: the study's objectives and its main results. Most studies designed and used chatbots to improve the mental health of pregnant women (40%) during the prenatal and postpartum periods. Three innovative chatbots were created to promote interaction and the sharing of experiences among mothers (30%). One chatbot was designed to promote child health. Also, one study evaluated the feasibility of a maternal care chatbot. At the same time, another refined the chatbot by analyzing conversations between mothers and the bot, highlighting the potential of technology to enhance maternal well-being (Table 4).

The primary aim of the studies conducted was to develop and evaluate a maternal care chatbot. In two of these studies, the specific objective was to improve maternal mental health, with a target of achieving a 40% enhancement. The main findings are as follows: Chatbots can effectively provide timely and relevant health information, particularly in areas, such as prenatal and postnatal care, dietary guidelines, and mental health. They also have the potential to positively impact children's health (10%). Furthermore, chatbot interventions can empower users, such as parents, by increasing their self-efficacy and reducing symptoms of depression (40%). This research indicates that chatbots offer timely, accessible, and personalized support, making them an invaluable resource.

Table 4. The objectives and main results of the studies

Author [ref]	Aims of the Study	Main Results
Bahja et al. [17]	To develop a chatbot for pregnant women to interact with each other, increase their awareness of antenatal care, diagnose their conditions, and evaluate them daily.	Alia presents a practical approach to chatbot applications, excelling in areas, such as attractiveness, clarity, efficiency, and overall user satisfaction.
Barreto et al. [18]	To develop a prototype of the GCBMB application to promote child health and evaluate the experiences of use and satisfaction with this application among mothers of newborn children.	The integration of chatbots into smartphones is poised to enhance children's health in Brazil significantly.
Chung et al. [23]	To develop and evaluate a user-friendly question-and-answer (Q&A) knowledge database-based chatbot (Dr. Joy) for the obstetric and mental health care of perinatal women and their partners by applying a text-mining technique.	This study meaningfully contributes to the literature by comparing the developed system with existing chatbots, like Dr. Joy, highlighting its design strengths and presenting compelling evidence of user experience values.
Montenegro et al. [24]	To investigate the use of chatbots to assist pregnant women during the prenatal and postnatal periods in Brazil.	Physicians described the experiment topics as assertive and comprehensive, covering prenatal and postnatal care, dietary guidelines, mild complications, physical activity, cosmetics, medications, and menstrual questions. Pregnant women affirmed the findings, highlighting their importance.
Sagstad et al. [25]	To leverage quantitative user data from the chatbot's log to enhance its development.	The results highlighted the urgent need to actively promote and integrate the chatbot into antenatal care while continuously improving the content to ensure timely and relevant information.
Inkster et al. [26]	To examine the effectiveness of Wysa by comparing changes in self-reported depressive symptoms between higher and lower engaged groups, and to understand the themes raised in a subset of user messages provided by higher engaged users.	A notable reduction in self-reported depressive symptoms was observed among the highly involved user group compared to the less involved user group, revealing key themes of concerns, aspirations, and expressions of gratitude.
Chua et al. [19]	To evaluate the effectiveness of the Parentbot in improving parenting self-efficacy (primary outcome), stress, depression, anxiety, social support, parent–child bonding, and parenting satisfaction (secondary outcomes) among parents throughout the perinatal period.	The Parentbot has proven effective in empowering parents and enhancing their self-efficacy during the perinatal period.
Chua et al. [27]	To explore the perinatal experiences of parents and examine user experiences of the PDA over the same period.	The PDA can provide parents with informational, socioemotional, and psychological support during the perinatal period.
Nguyen et al. [28]	To assess the feasibility and acceptability of a health chatbot for new mothers of color.	The Rosie app serves as an essential innovation for both pregnancy and postpartum support.
Mancinelli et al. [29]	to qualitatively evaluate pregnant women's experiences with a chatbot (Juno) prototype designed to deploy a preventive behavioral activation intervention.	While Juno effectively provides immediate assistance, it underscores the critical importance of human interaction in mental health care. Additionally, it is crucial to educate users about the limitations of chatbots to mitigate the risk of overreliance.

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However, further studies are needed to draw definitive conclusions. These findings highlight the importance of ongoing research and the development of chatbot technologies to optimize their effectiveness in healthcare.

Discussion

This systematic review assessed the effectiveness of chatbots in the context of maternal and child healthcare. A total of 10 articles were meticulously analyzed for this review, which categorized the studies into mixed-method, qualitative, observational, and randomized con-

trolled trials (RCTs). The findings indicated that chatbots provide valuable services that encompass both interactive and informative components, as well as psychological support. Overall, the evaluation of the chatbot models yielded favorable results, demonstrating a high level of acceptance among users.

This review endorses the integration of chatbots in maternal and child healthcare. A significant finding is their effectiveness in improving maternal mental health during the antenatal and postnatal periods. Chatbots offer emotional support, alleviate symptoms of depression and anxiety, and encourage healthy coping mechanisms. Numerous studies have demonstrated positive outcomes that reinforce this potential [4, 23, 27, 30]. A systematic review of chatbots used for mental health improvement found that they effectively reduce symptoms of depression, anxiety, stress, and acrophobia. However, no statistically significant impact on subjective psychological well-being was observed [31]. Research suggests that chatbots may have the potential to improve maternal mental health. However, the current evidence is not robust enough to draw conclusive findings. Accordingly, further investigation is needed to thoroughly evaluate the effectiveness and safety of chatbots in this context. It is important to note that the evidence available for each outcome is derived from a limited number of studies, most of which had small sample sizes, and the methodologies employed in these studies varied considerably.

There is generally a positive attitude toward using chatbot technology to enhance health outcomes [32, 33]. Furthermore, the development of chatbots aimed at facilitating social interaction and peer support among mothers represents a promising avenue for future research. The results of several studies support these findings [23, 26, 29, 34]. Unlike human agents, chatbots can efficiently handle numerous users at once, saving time and effort while still offering users the feeling of human interaction [9]. AI chatbots offer new ways for individuals to receive, understand, and use information, suggestions, and support on a personal level, which can help address a lack of self-efficacy or social support [35]. These insights underscore the importance of continued exploration of chatbot technology's potential to enhance healthcare for mothers and children. Studies show its potential to positively impact pregnancy and women's care [23, 36–38]. Thus, healthcare providers could consider incorporating chatbots as a supplementary tool to improve the effectiveness of existing interventions [31].

A key strength of our review lies in its systematic approach, providing a comprehensive overview of the current literature. However, several limitations must be acknowledged. The heterogeneity of the included studies, particularly regarding methodologies and sample sizes, precluded a meta-analysis, limiting our ability to synthesize the data quantitatively. Furthermore, the predominantly high- and middle-income country context of the included studies raises concerns about the generalizability of our findings to low-income settings, where access to technology and healthcare resources may differ significantly. Future research should prioritize investigating the effectiveness of chatbots in diverse cultural and socioeconomic contexts.

Although the included studies demonstrated the potential of chatbots in improving maternal mental health and fostering connections, the evidence base for the use of chatbots in maternal health still needs to be improved, and the quality of studies varied. Furthermore, the long-term effectiveness and sustainability of chatbot interventions still need to be determined. Therefore, longitudinal studies are required in order to assess the long-term effectiveness and sustainability of chatbot interventions.

Future research could address several limitations identified in current studies. This includes developing customized chatbot interventions that effectively address the unique needs of individual women. Future research should focus on developing and rigorously evaluating culturally sensitive and personalized chatbot interventions tailored to the specific needs of individual women, including minority populations, to promote equity in maternal healthcare. The potential for chatbots to promote equity in maternal health care for minority populations is significant. Furthermore, a comprehensive study on the effectiveness and safety of AI chatbots should be conducted to emphasize their contributions to this critical area of healthcare. It is also important to address ethical concerns related to data privacy, algorithmic bias, and the potential risks associated with an over-reliance on technology. It is crucial to address ethical considerations related to data privacy, algorithmic bias, and the risk of over-reliance on technology when implementing chatbots in maternal and child healthcare. Future research should focus on methods to mitigate potential biases in chatbot algorithms and protect user data privacy. By tackling these challenges and pursuing recommended research avenues, we can gain a clearer understanding of the true potential of chatbots to improve maternal and child health outcomes.

Also, we suggest that healthcare providers view chatbots as supplementary tools to enhance current maternal healthcare interventions rather than as a replacement for traditional care.

Conclusion

This systematic review examined the potential of chatbots to support maternal health, specifically in fostering connections among mothers and peer support groups. While chatbots show promise in providing companionship, information, and support during the critical perinatal period, the current body of evidence needs improvement. Our findings indicate that chatbots may be beneficial in these areas; however, more rigorous, high-quality research is essential to understand their impact and fully address existing knowledge gaps. Future studies should focus on the optimal design and implementation of chatbot interventions, including their integration within existing healthcare systems, while also considering challenges, such as privacy concerns and the digital divide. Additionally, a collaborative approach involving healthcare providers, technology developers, and researchers from various fields is crucial to ensure that these tools are effective, accessible, and responsive to the diverse needs of expectant and new mothers. This teamwork will be vital to maximize the potential of chatbots to enhance maternal health and well-being.

Ethical Considerations

Compliance with ethical guidelines

There were no ethical considerations to be considered in this research.

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Authors' contributions

All authors contributed equally to the conception and design of the study, data collection and analysis, interpretation of the results, and drafting of the manuscript. Each author approved the final version of the manuscript for submission.

Conflict of interest

The authors declared no conflicts of interest.

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